



- Use the materials and tools precisely to compare between transverse and longitudinal waves.
- Classify waves according to their direction of propagation.
- Classify waves according to the ability to propagate and transfer energy in space.
- Compare between transverse and longitudinal waves.
- Recognize the concepts related to the wave motion and their properties.
- Recognize the relation used to determine the wave velocity.
- Conclude the relation between the frequency of the wave and its periodic time.
- Conclude the law of wave propagation.
- Compare between oscillatory motion and wave motion.
- Protect the ears against the hazards of noise pollution.



## Oscillatory Motion



# Have

you ever thought about motion and its types ?!

There are two types of motion, which are :

- *Transitional motion.*
- (Which you have studied in the last year)
- *Periodic motion.*

## Periodic motion:

It is a motion, which is regularly repeated in equal periods of time.

## Examples of periodic motion

### A Oscillatory motion.



### B Wave motion.





## Lesson One

► In this lesson, we are going to study the oscillatory motion :

1. The concept of oscillatory motion.
2. Graphical representation of the oscillatory motion.
3. Properties of oscillatory motion.

1

## The concept of oscillatory motion :



## ACTIVITY 1

Defining the concept of oscillatory motion :



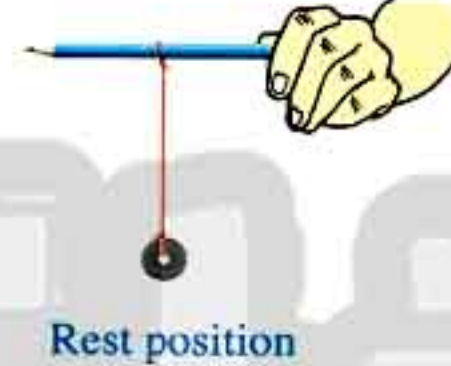
## Materials and tools :

- A pencil.
- A 30 cm long thread.
- A metallic piece.



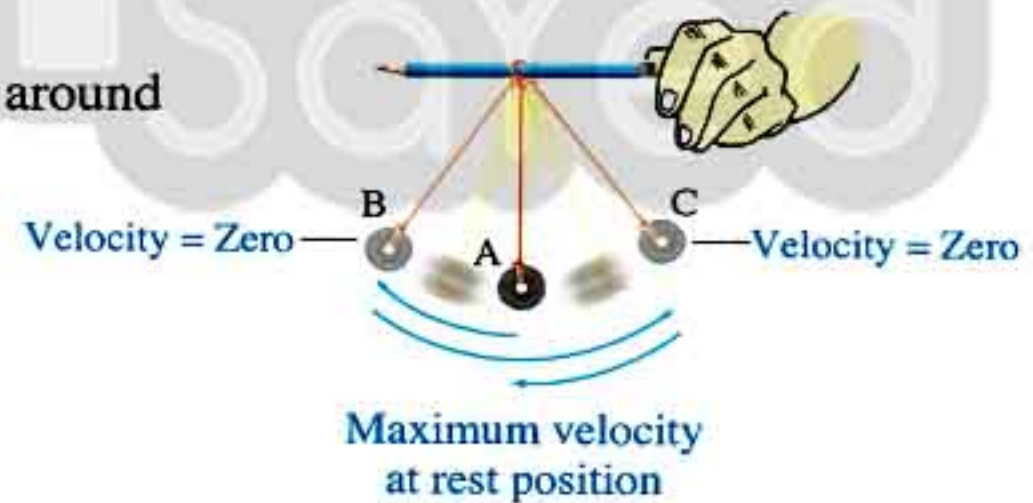
## Steps :

1. Make a simple pendulum as shown in the figure.  
(A metallic piece, which is tied to one end of a thread, while the other end is tied to a pencil).
2. Pull the metallic piece (the oscillating body) to the right side (B) of its rest position (original position A), then leave it.
3. Record the time taken by the metallic piece to repeat its movement several times.



## Observations :

1. The oscillating body moves on both sides around its rest position (A). This motion is repeated in equal time intervals.
2. The displacements of the oscillating body around its rest position are equal.
3. The velocity of the oscillating body reaches its **maximum** value when it passes its **rest position** and **decreases** gradually when it goes far from it until it **reaches zero** at the **maximum displacement** on both sides of rest position.



## Conclusion :

The oscillating body moves around its rest position, where the motion is repeated through equal intervals of time which is known as "Oscillatory motion".

Oscillatory motion:

It is the motion of the oscillating body around its rest point, where the motion is repeated through equal intervals of time.



## UNIT

## 1

## ➤ Relation between the velocity of an oscillating body and its kinetic energy :

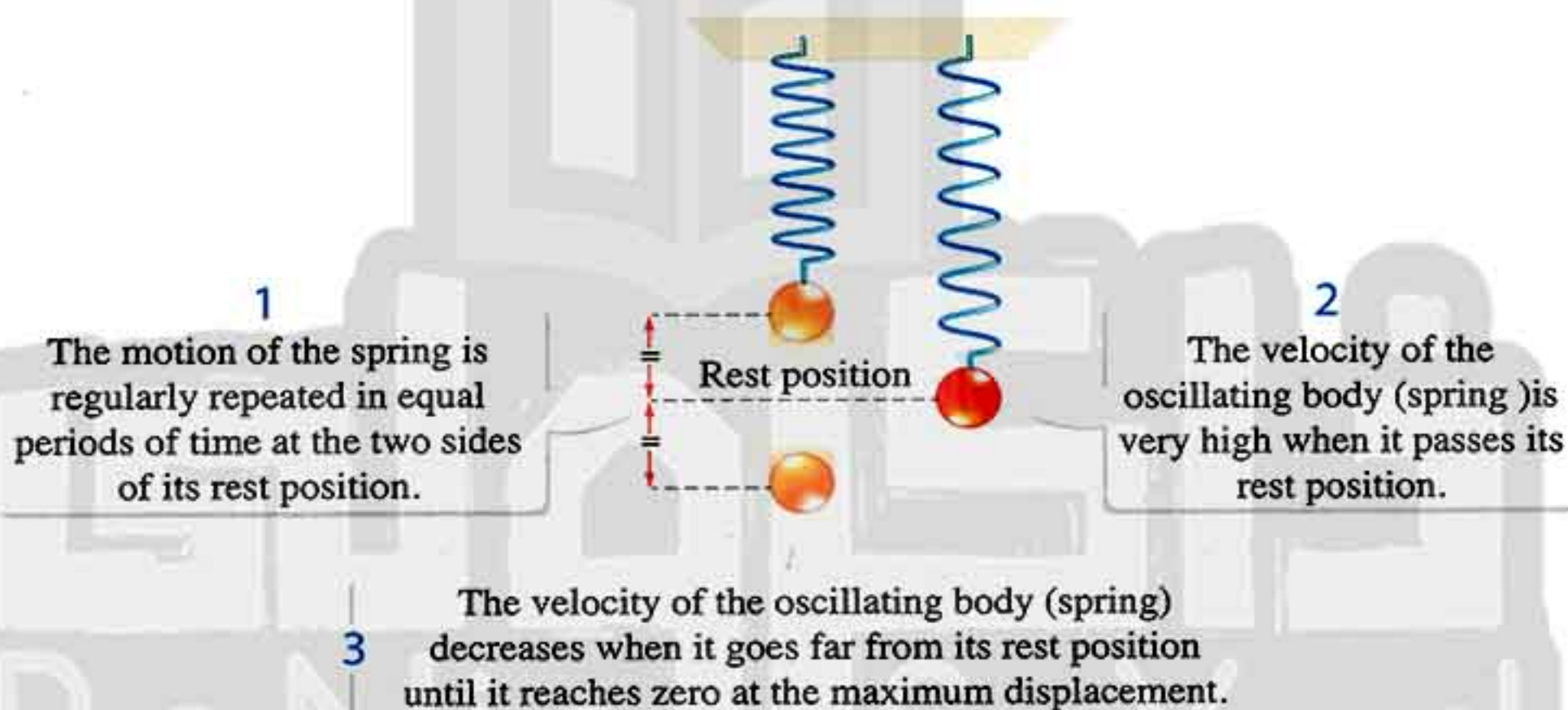
$$\text{The kinetic energy} = \frac{1}{2} (\text{mass} \times \text{squared velocity}) = \frac{1}{2} mv^2$$

The kinetic energy of an oscillating body is directly proportional with :

- mass of the oscillating body.
- squared velocity of the oscillating body.

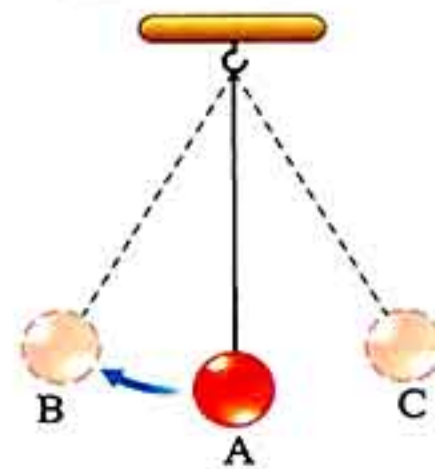
So, the kinetic energy increases when the velocity of the oscillating body increases and vice versa.

## ➤ The following figure refers to the application of the concept of oscillatory motion on the motion of the spring:

❓ **Question** ( Answer the following question :

The opposite figure represents an oscillatory motion for a simple pendulum. Answer the following questions :

- The maximum velocity of the pendulum is at point(s) ..... (A / B / C / C , A)
- The maximum kinetic energy of the pendulum is at point(s) ..... (A / B / C / C , B)
- The kinetic energy of the pendulum vanishes (equals zero) at point(s) ..... (A / B / C / B , C)

✔ **Answer**

a. A

b. A

c. B , C





## Examples of oscillatory motion :



### Note

The motion of rotary bee is considered as a periodic motion because it is repeated regularly at equal time intervals, but it is not oscillatory motion, because it is not repeated on the two sides of its rest position.



Rotary bee

### GR

- **The velocity of the simple pendulum reaches to a maximum value.**  
As it passes its rest position.
- **The motion of spring is considered as an oscillatory periodic motion.**  
Because it is repeated on the two sides of its rest position through equal intervals of time.
- **The velocity of the body is taken as a measure of its kinetic energy.**  
Because kinetic energy =  $\frac{1}{2} \text{ mass} \times (\text{velocity})^2$ .



## UNIT

## 1

## ► Enrichment information

Examples of oscillatory motion :

- The movement of the Earth's crust during earthquakes.
- The movement of atoms in molecules.

## 2

## Graphical representation of the oscillatory motion :

The oscillatory motion of the spring can be represented graphically as shown in the following activity :



## ACTIVITY

## 2

## Graphical representation of oscillatory motion :



**Materials and tools :** • A smooth paper tape rolled around two rolls.  
• Spring. • Weight. • Holder. • Pencil.

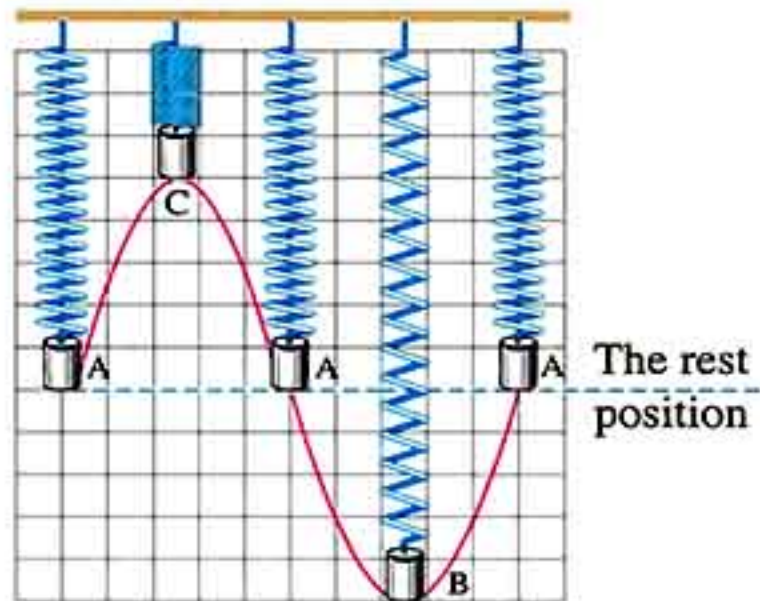


| Steps   | Figure | Observation   |
|---|--------|---|
| <ol style="list-style-type: none"> <li>1. Fix the pencil to the weight, then tie the weight at one end of the spring.</li> <li>2. Tie the other end of the spring at the holder, so that the pencil's tip touches the midpoint of the paper tape (as shown in the fig.).</li> <li>3. Roll the paper tape regularly, then pull the weight downwards and leave it.</li> </ol> |        | <p>The pencil draws the shape of the oscillatory motion on the paper tape as shown in the figure.</p> |



## Conclusion :

The simple harmonic motion is considered the simplest form of oscillatory motion.



Graphical representation of oscillatory motion  
(Simple harmonic motion)

TRY

TO ANSWER worksheet  
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1



3

**Properties of oscillatory motion :**

Properties of oscillatory motion are expressed in terms of many concepts, such as :

① Amplitude

② Complete oscillation

③ Periodic time

④ Frequency

1

**Amplitude****Amplitude:**

It is the maximum displacement done by the oscillating body away from its rest position.

- \* The measuring unit of the amplitude is metre "m" or centimetre "cm".

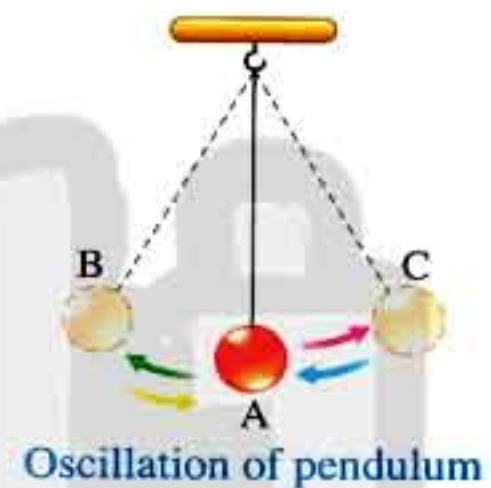
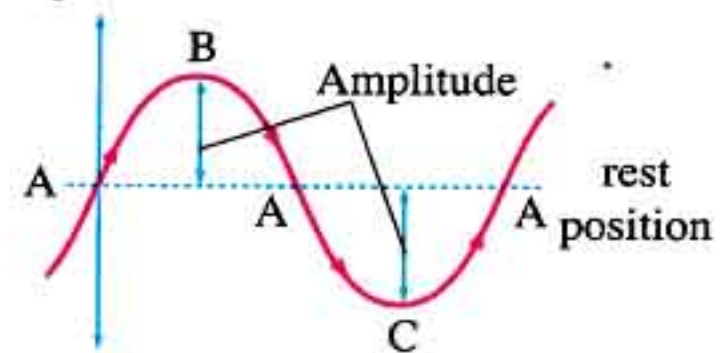
In the simple pendulum, the oscillating body makes :

- The maximum displacement on the right side at point (B).
- The maximum displacement on the left side at point (C).

- The displacements  $\overrightarrow{AB} = \overrightarrow{BA} = \overrightarrow{AC} = \overrightarrow{CA}$

Each of them is called "Amplitude"

Displacement

**? What is meant by ?**

The amplitude of an oscillating body is 20 cm.

- This means that the maximum displacement of the oscillating body away from its rest position is 20 cm.

The maximum displacement of the oscillating body is 4 cm.

- This means that the amplitude of the oscillating body is 4 cm.

2

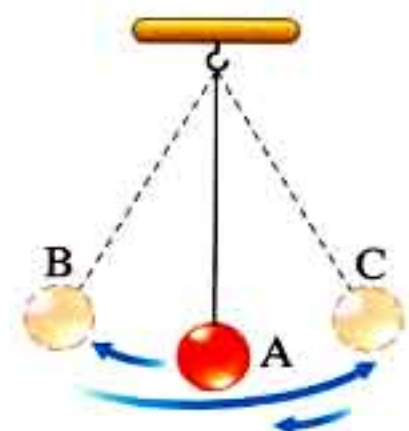
**Complete oscillation****Complete oscillation:**

It is the motion of an oscillating body when it passes by a fixed point on its path two successive times in the same direction.

During the motion of the oscillating body, it moves from (A) to (B), then to (C) passing by (A), then returns back to (A) again, so it is said that it has made a **complete oscillation**,

And it can be written as follows :

A → B → A → C → A





## UNIT

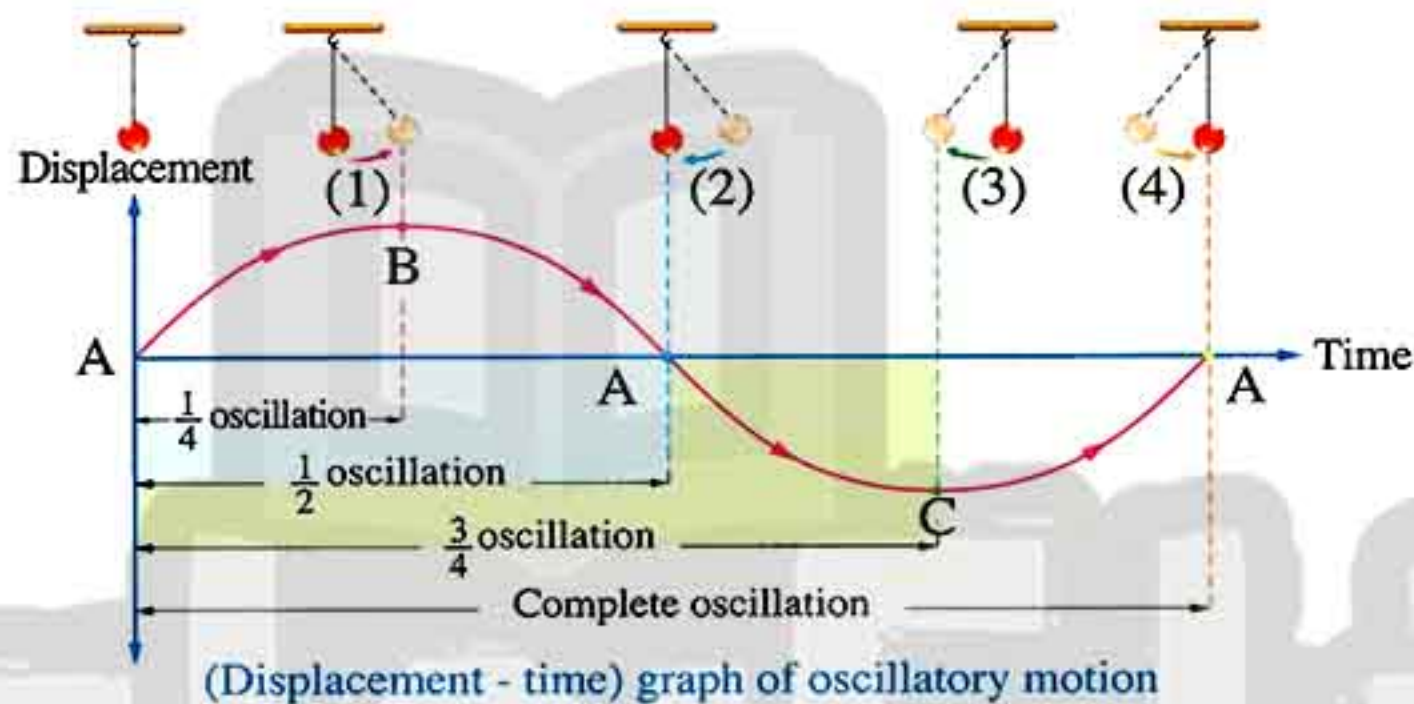
## 1

- The following graph refers to the relation between the displacement and the time taken for a simple harmonic motion of a simple pendulum.
- From the figure, we conclude that the **complete oscillation** includes four amplitudes.

**Note**

Complete oscillation = 4 amplitudes

Amplitude =  $\frac{1}{4}$  complete oscillation

**Exercise 1**

1. In which graph, the amplitude is larger ?
2. How many complete oscillations exist between the points X and Y represented on both graphs ?

**Answer**

1. Amplitude of curve (1) is larger than the amplitude of curve (2).
2. The number of complete oscillations between points X and Y are :
  - In curve (1) : three (3) complete oscillations.
  - In curve (2) : four (4) complete oscillations.

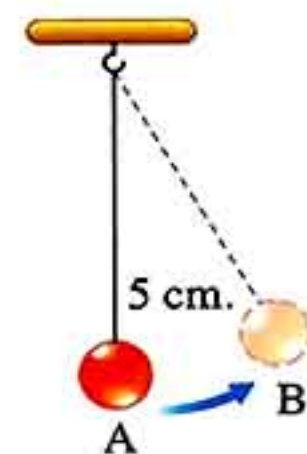
**Exercise 2**

In the opposite figure, calculate the distance covered by the pendulum to make 3 complete oscillations.

**Answer**

Distance of one complete oscillation =  $4 \times \text{amplitude}$   
 $= 4 \times 5 \text{ cm} = 20 \text{ cm}.$

Distance of 3 complete oscillation =  $3 \times 20 \text{ cm} = 60 \text{ cm}.$





**Exercise 3**

Calculate the amplitude of a pendulum which covers a distance of 80 cm. to make one complete oscillation.

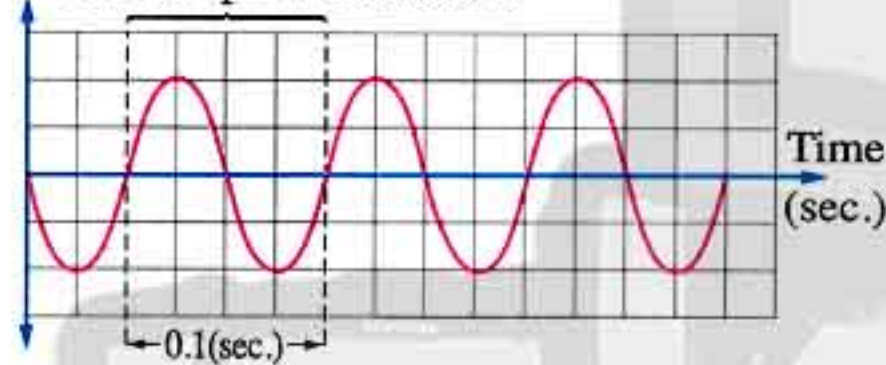
**Answer**

$$\begin{aligned}\text{Amplitude} &= \frac{1}{4} \text{ complete oscillation} \\ &= \frac{1}{4} \times 80 \text{ cm.} = 20 \text{ cm.}\end{aligned}$$

**3****Periodic time (T)**

Displacement (m.)

one complete oscillation



Periodic time = 0.1 sec.

**Defination****Periodic time :**

It is the time taken by an oscillating body to make one complete oscillation.

**Measuring unit**

Second (sec.)

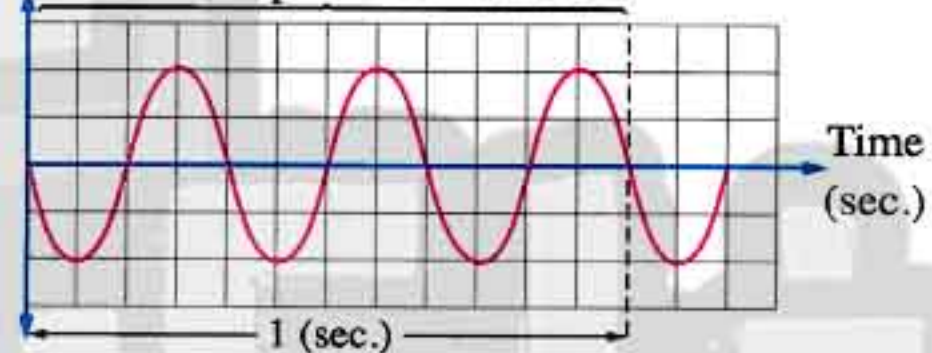
**Explanation**

When the oscillating body needs a time of 0.5 sec. to make one amplitude, so it takes  $0.5 \times 4 = 2$  sec. to make one complete oscillation and this is known by **periodic time**.

**4****Frequency (F)**

Displacement (m.)

Three complete oscillations



Frequency = 3 oscillations / sec.

**Frequency :**

It is the number of complete oscillations made by an oscillating body in one second.

Hertz (Hz)

"Related to the German scientist Hertz"

When a simple pendulum makes 50 complete oscillations in 10 seconds, so the number of complete oscillations made in one second =  $\frac{50}{10} = 5$  complete oscillations / second and this is known as the **frequency** of this pendulum.



## UNIT

## 1

## What is meant by ?

The periodic time of an oscillating body is 0.2 sec.

This means that the time taken by this oscillating body to make one complete oscillation is 0.2 sec.

The frequency of an oscillating body is 20 Hertz.

This means that the number of complete oscillations made by the oscillating body in one sec. is 20 complete oscillations.

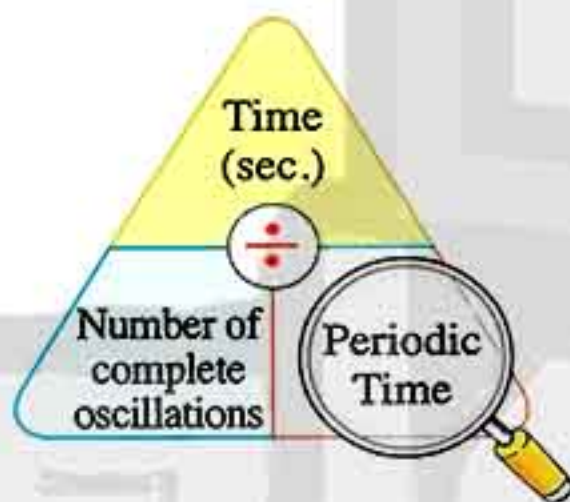
## Law used

## The periodic time

=

Time in seconds

Number of complete oscillations made in that time (I)

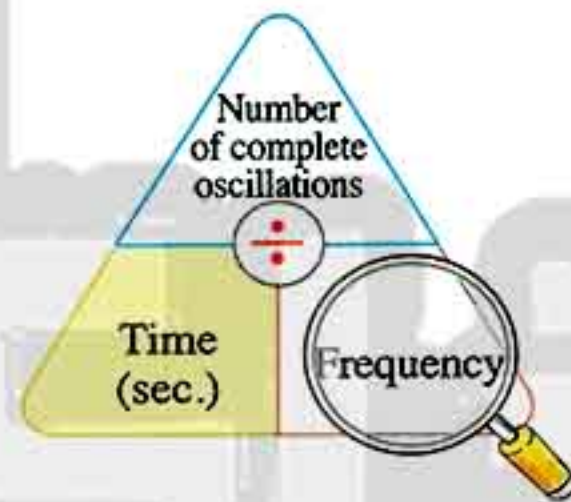


## Frequency

=

Number of complete oscillations

Time taken in seconds (II)



From I and II we can notice that :

The periodic time is the reciprocal of the frequency.

## The relation between frequency and periodic time :

From equations (I) and (II), we can conclude that :

Frequency  $\times$  Periodic time = 1

Frequency (F)

=

$$\frac{1}{\text{Periodic time (T)}}$$

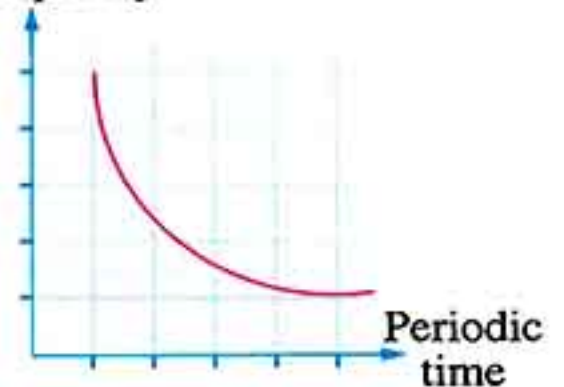
And so,

Periodic time (T)

=

$$\frac{1}{\text{Frequency (F)}}$$

Frequency



i.e. the relation between periodic time and frequency is an inverse relation

“ frequency decreases by increasing periodic time and vice versa.”



## Lesson One

## Note

The value of the periodic time will be equal to that of the frequency when the number of complete oscillations made by the oscillating body equals to the time taken by second.

## Example :

If the number of complete oscillations made by an oscillating body in one minute = 60 complete oscillation.

$$1 \text{ minute} = 60 \text{ sec.}$$

So :

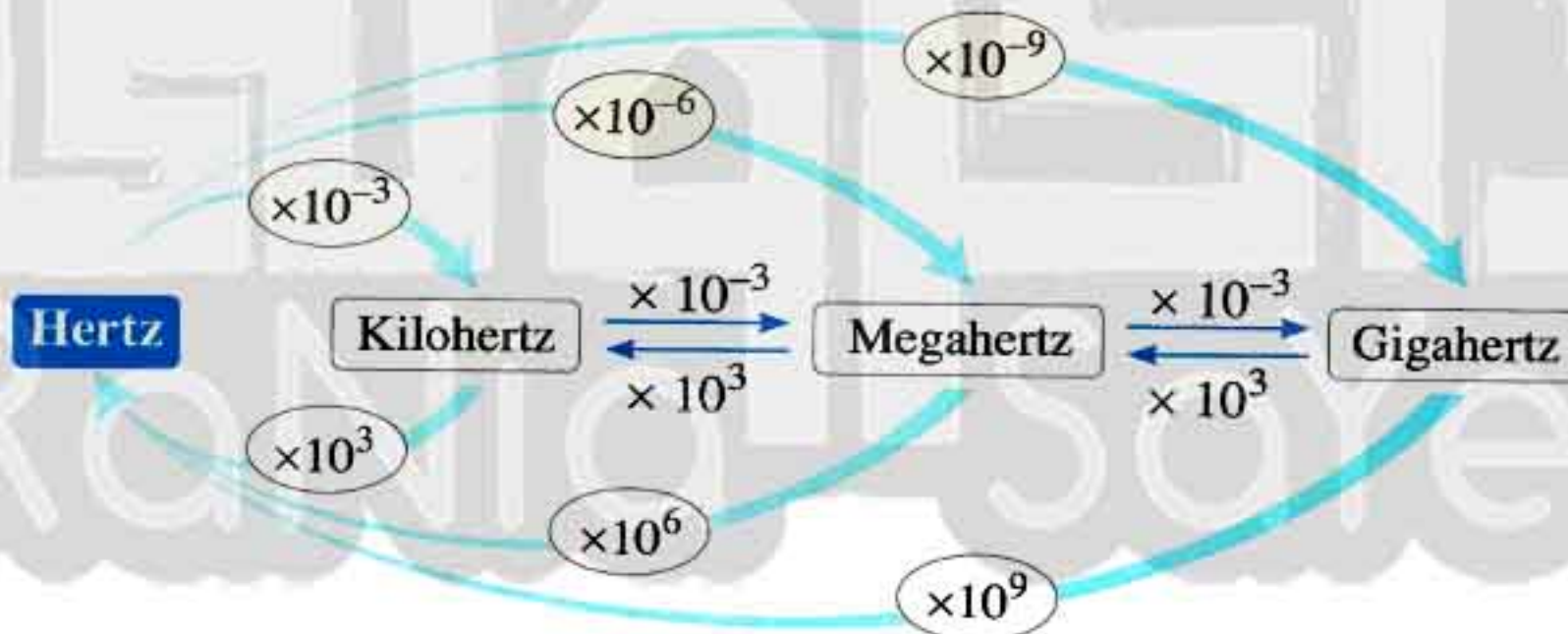
A. The periodic time =  $\frac{60}{60} = 1 \text{ sec.}$

B. The frequency =  $\frac{60}{60} = 1 \text{ Hertz.}$

## Fractions of Hertz :

- Kilohertz (KHz)
- Megahertz (MHz).
- Gigahertz (GHz).

The following chart shows the conversions of these fractions :



- Kilohertz =  $1 \times 10^3$  Hertz      - Megahertz =  $1 \times 10^6$  Hertz      - Gigahertz =  $1 \times 10^9$  Hertz

## Problem:

Calculate the periodic time and frequency of an oscillating body that makes 300 complete oscillations in half a minute.

## Solution

$$t = 0.5 \times 60 = 30 \text{ seconds}$$

$$\text{Periodic time (T)} = \frac{\text{Time (t) (seconds)}}{\text{No. of complete oscillations}} = \frac{30}{300} = 0.1 \text{ second}$$

$$\text{Frequency (F)} = \frac{1}{T} = \frac{1}{0.1} = 10 \text{ Hz}$$



## UNIT

## 1

## The relation between periodic time and the time of amplitude :

\* Periodic time = the time of complete oscillation.

So, periodic time =  $4 \times$  the time of amplitude.

From the last relation we can conclude that :

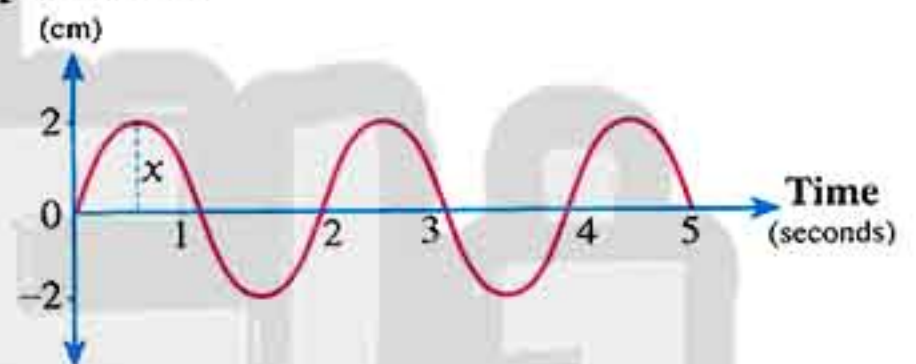
The time of amplitude =  $\frac{1}{4}$  the periodic time

## Problem :

From the opposite figure of the oscillatory motion of a simple pendulum, calculate :

- (1) Amplitude.
- (2) Periodic time.
- (3) The time of amplitude.
- (4) Frequency in megahertz.

Displacements



## Solution

- (1) Amplitude ( $x$ ) = 2 cm
- (2) Periodic time (T) (time of one oscillation) = 2 seconds
- (3) The time of amplitude =  $\frac{1}{4}$  the periodic time =  $\frac{1}{4} \times 2 = 0.5$  sec.
- (4) Frequency (F) =  $\frac{1}{T} = \frac{1}{2} = 0.5$  Hz =  $0.5 \times 10^{-6}$  megahertz.

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2



# Remember

## Types of Motion

Transitional motion

Periodic motion

### ★ Periodic motion :

It is a motion, which is regularly repeated in equal periods of time.

### ★ Oscillatory motion :

It is the motion of the oscillating body around its rest point, where motion is repeated through equal intervals of time.

#### Some concepts related to the oscillatory motion

1 Amplitude

2 Complete oscillation

3 Periodic time

4 Frequency

#### 1 Amplitude :

It is the maximum displacement done by the oscillating body away from its rest position.

#### 2 Complete oscillation :

It is the motion of an oscillating body when it passes by a fixed point on its path two successive times in the same direction.

#### 3 Periodic time :

It is the time taken by an oscillating body to make one complete oscillation.

#### 4 Frequency :

It is the number of complete oscillations made by an oscillating body in one second.

$$\star \text{ Periodic time} = \frac{\text{Time in seconds}}{\text{Number of complete oscillations made in that time}}$$

$$\star \text{ Frequency} = \frac{\text{Number of complete oscillations}}{\text{Time taken in seconds}}$$


$$\star \text{ Frequency (F)} = \frac{1}{\text{Periodic time (t)}}$$

$$\star \text{ Periodic time (t)} = \frac{1}{\text{Frequency (F)}}$$




# Questions

## on lesson one

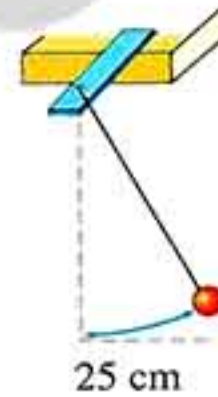
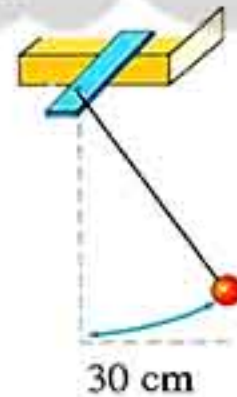
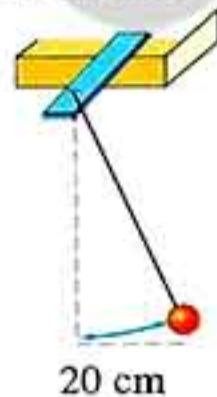
Questions signed by  have been taken from the school book.



### 1. Choose the correct answer :

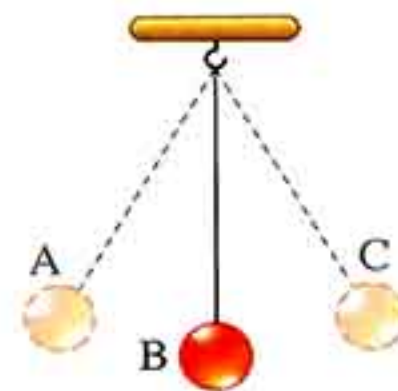
- The movement of a swing is known as .....  
 a. transitional motion.                      b. oscillatory motion.  
 c. wave motion.                                d. (a) and (b) together.
- The oscillating body moves at the two sides of its rest position, so its velocity .....  
 a. decreases when it goes far from its rest position.  
 b. increases when it goes far from its rest position.  
 c. will reach its maximum value when it passes its rest position.  
 d. (a) and (c) together.
- Kinetic energy =  $\frac{1}{2} \times$  .....  
 a.  $\frac{m}{v^2}$                       b.  $mv^2$                       c.  $m^2v^2$                       d.  $mv^3$
- All of the following are examples of oscillatory motion except .....  
 a. motion of string.                              b. motion of a tuning fork.  
 c. motion of car.                                  d. motion of a simple pendulum.
- The amplitude of the simple pendulum is ..... of a complete vibration.  
 a. four times                      b. a quarter                      c. a half                      d. double
-  The following figures describe the oscillation of a simple pendulum at different intervals of time. The amplitude of such pendulum = .....

- 30 cm
- 25 cm
- 20 cm
- 10 cm






- Which motion of the following represents a complete oscillation for the given simple pendulum ? .....

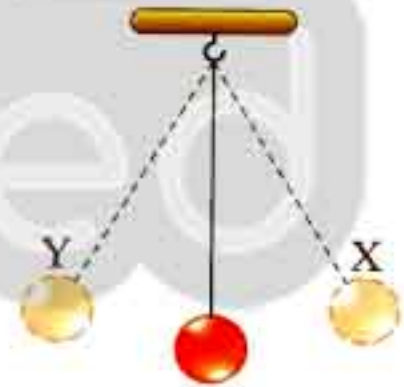
- C  $\longrightarrow$  B  $\longrightarrow$  A  $\longrightarrow$  B
- A  $\longrightarrow$  B  $\longrightarrow$  C  $\longrightarrow$  B  $\longrightarrow$  A
- A  $\longrightarrow$  B  $\longrightarrow$  C
- B  $\longrightarrow$  C  $\longrightarrow$  B  $\longrightarrow$  A





## Lesson One

8. The maximum displacement made by the oscillating body away from its rest position is .....
- a. amplitude.                      b. frequency.                      c. periodic time.                      d. complete oscillation.
9. The complete oscillation includes ..... displacements.
- a. one                      b. two successive                      c. three successive                      d. four successive
10. The periodic time is the time of ..... oscillation.
- a.  $\frac{1}{4}$                       b.  $\frac{1}{2}$                       c.  $\frac{1}{5}$                       d. one complete
11. If the periodic time of an oscillating body is 0.1 sec., so the number of complete oscillations in one minute is .....
- a. 10                      b. 600                      c. 120                      d. 60
12. The number of complete oscillations that are made by an oscillating body in one second is known as .....
- a. periodic time.                      b. amplitude.                      c. frequency.                      d. complete oscillation.
13. The frequency of the oscillating body is measured by a unit called .....
- a. Hertz.                      b. watt/m.                      c. decibel.                      d. m/sec.
14.  The result of multiplying the frequency of an oscillating body by its periodic time equals .....
- a.  $\frac{1}{2}$                       b.  $\frac{1}{4}$                       c.  $\frac{1}{3}$                       d. 1
15.  In the opposite figure, when the ball of the pendulum moves from (X) to (Y) in a duration of 0.02 seconds, the frequency equals ..... Hertz.
- a. 0.04                      b. 0.02                      c. 25                      d. 50
16.  If the frequency of an oscillating body is 6 Hz, so periodic time is .....
- a. 3 sec.                      b. 6 sec.                      c.  $\frac{1}{3}$  sec.                      d.  $\frac{1}{6}$  sec.
17. If the periodic time of an oscillating body is  $\frac{1}{6}$  second, this means that .....
- a. the oscillating body makes 6 complete oscillations in one minute.  
b. the frequency of the oscillating body equals 6 Hz.  
c. the oscillating body makes 360 complete oscillations in one minute.  
d. (b) and (c) are correct.
18. The periodic time of an oscillating body which makes 240 oscillations in one minute equals .....
- a. 1 sec.                      b.  $\frac{1}{4}$  sec.                      c.  $\frac{1}{2}$  sec.                      d. 4 sec.





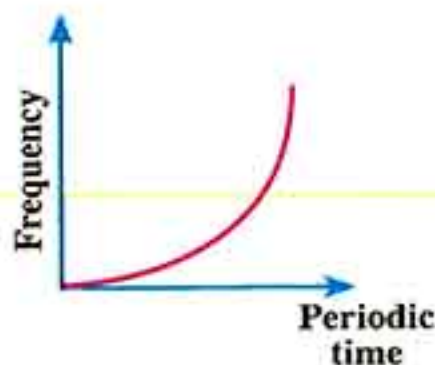
## UNIT

## 1

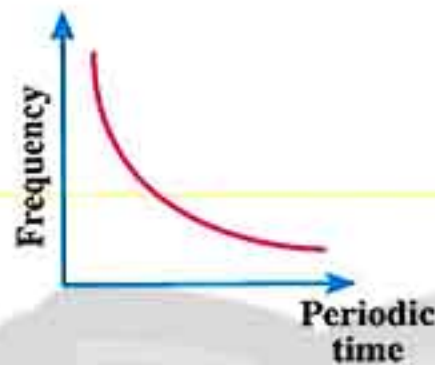
19. A simple pendulum makes 540 complete oscillations in a minute, so its frequency is ..... Hz.

- a. 3                      b. 6                      c. 9                      d. 12

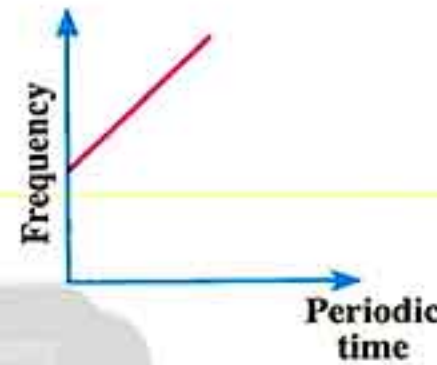
20. Which of the following graphs represents the relation between frequency and periodic time ? .....



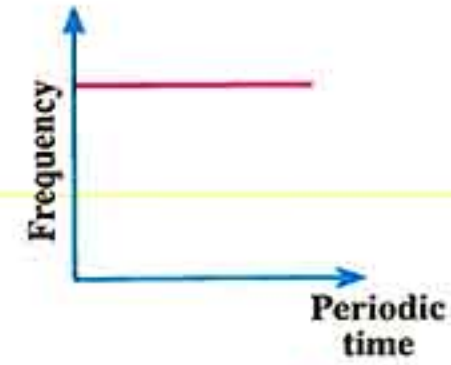
(a)



(b)



(c)



(d)

21. 1 Gigahertz = ..... Kiloherzt.

- a.  $10^2$                       b.  $10^3$                       c.  $10^6$                       d.  $10^9$

22. If the frequency of an oscillating body is 5 Hz, So the product of multiplying its frequency by its periodic time equals .....

- a. 1                      b. 5                      c. 10                      d. 25

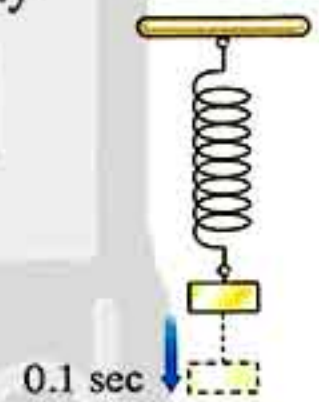
23. In the opposite figure, if the maximum displacement done by the spring away from its rest position is 3 cm. Using the figure calculate :

1. The vertical distance covered by the spring through 3 complete oscillations equals ..... cm.

- a. 3                      b. 12                      c. 24                      d. 36

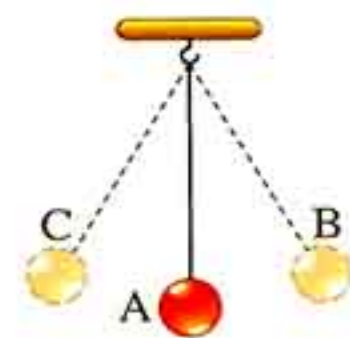
2. The frequency of the spring equals ..... Hz.

- a. 0.2                      b. 0.4                      c. 2.5                      d. 5



## 2. Put (✓) or (x) and correct what is wrong :

- The oscillatory motion is regularly repeated through equal intervals of time. ( )
- The motion of stretched string is a wave motion. ( )
- The swing is an example of periodic motion. ( )
- The tuning fork oscillation is an example of the periodic motion. ( )
- The kinetic energy of the simple pendulum decreases by increasing its velocity. ( )
- The velocity of the oscillating body reaches its maximum value when it passes its rest position. ( )
- The simple harmonic motion is a form of oscillatory motion. ( )
- The motion from C to A to B to A is a complete oscillation. ( )
- The amplitude is measured in a metre. ( )







## Lesson One

10. Frequency is the number of complete oscillations made by the oscillating body in one second. ( )
11. The frequency of the oscillating body is the reciprocal of the periodic time. ( )
12. The oscillating body of frequency 360 Hz makes 180 complete oscillations in half a minute. ( )
13. A vibrating body makes  $\frac{1}{4}$  complete vibration in  $\frac{1}{64}$  sec., its frequency is 6 Hz. ( )

### 3. Write the scientific term of each of the following :

1. The motion, which is regularly repeated in equal periods of time.
2.  The periodic motion made by a body around its point of rest, where the motion is repeated through equal intervals of time.
3. The maximum displacement done by the oscillating body away from its rest position.
4. The motion of an oscillating body when it passes by a fixed point in its path two successive times in the same direction.
5. The time taken by the oscillating body to make one complete oscillation.
6. The measuring unit of the periodic time.
7.  The number of complete oscillations produced by the oscillating body in one second.
8. The measuring unit of frequency.

### 4. Complete the following statements :

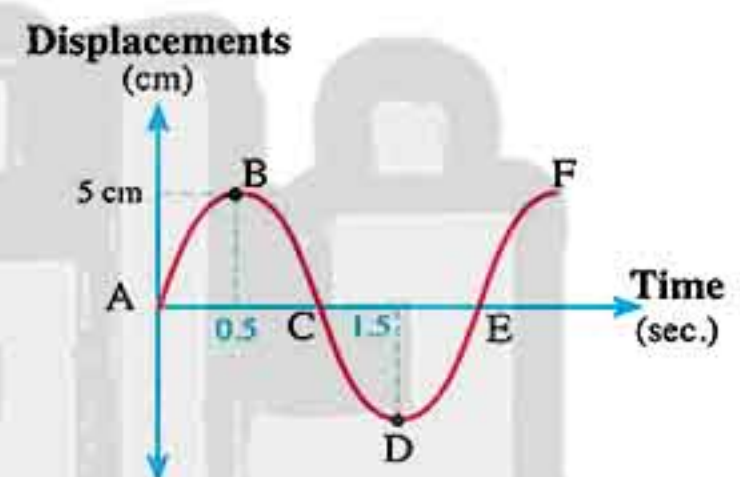
1. .... motion is the motion, which is regularly ..... in equal periods of time.
2. There are two types of periodic motion which are ..... motion and ..... motion.
3. The velocity of the oscillating body reaches its maximum value when it passes its .....
4. The kinetic energy of the oscillating body reaches its ..... value when it passes its rest position.
5. The movement of a swing is an example of ..... motion because it repeats its movement in ..... periods of time.
6. The movement of ..... , ..... and ..... are examples of oscillatory motion.
7. The motion of rotary bee is not considered as (a/an) ..... motion although it is (a/an) ..... motion.
8. The simple harmonic motion is an example of the .....
9. The amplitude is ..... and its measuring unit is .....
10. The complete oscillation comprises ..... successive maximum displacements, each one is called .....



## UNIT

## 1

11. Frequency =  $\frac{\dots\dots\dots}{\text{Periodic time (seconds)}}$
12. For the memorial of the scientist Hertz, the measuring unit of frequency is ..... which is symbolized by .....
13. Megahertz equals ..... Hz and gigahertz equals ..... Hz.
14. The periodic time is the time of ..... and its measuring unit is .....
15. Frequency is ..... proportional to the periodic time.
16. If the maximum displacement done by the oscillating body away from its rest position is 0.2 cm which is made in 0.5 second, so its amplitude is ..... and the periodic time is .....
17. When an oscillating body makes 600 complete cycles per a minute, its frequency equals .....
18. If the periodic time of an oscillating body is 0.2 seconds, so the time taken to do 5 complete oscillations is .....
19. The opposite figure represents the oscillatory motion of a spring. Answer :
- The amplitude = .....
  - The periodic time = .....
  - The complete oscillation is represented between points A, ..... , C , D and .....
20. (Frequency  $\times$  Periodic time) - 1 = .....

**5. Give reasons for :**



- The oscillatory motion is considered as a periodic motion.
  - The motion of planets around the Sun is considered as a periodic motion.
- The motion of spring is considered as an oscillatory motion.
- The velocity of the body is taken as a measure of its kinetic energy.
- The motion of the rotary bee is a periodic motion.
- The periodic time decreases as the number of complete oscillations increases.
- The frequency of the vibrating body decreases by increasing the periodic time.
- The product of frequency and periodic time equals unity.
- The kinetic energy of a pendulum is maximum when the pendulum passes its rest position.

**6. Define each of the following :**

- |                     |                          |
|---------------------|--------------------------|
| 1. Periodic motion. | 2. Oscillatory motion.   |
| 3. Amplitude.       | 4. Complete oscillation. |
| 5. Periodic time.   | 6. Frequency.            |



**7. What is meant by .... ?**

1. The maximum displacement made by an oscillating body is 6 cm.
2.  The time taken by a spring to make 60 complete oscillations is 1 minute.
3. The periodic time of a tuning fork is 0.5 sec.
4. The frequency of a simple pendulum is 50 Hertz.
5.  The number of complete oscillations made by an oscillating body in 10 seconds is 500 complete oscillations.
6. The oscillating body makes 30 oscillations in one second.
7. The oscillating body makes 240 oscillations in half a minute.

**8. What happens when .... ?**

1. The oscillating body passes its rest position during its movement.  
(Concerning its kinetic energy)
2. The oscillating body reaches the position of its maximum displacement during its movement.  
(Concerning its kinetic energy)

**9. Mention the unit used for measuring each of the following :**

1. Periodic time.
2. Amplitude.
3. Frequency.

**10. Mention the mathematical relation between each of the following :**

1. Amplitude and complete oscillation of an oscillating body.
2. Periodic time and number of complete oscillations made by an oscillating body in a certain time.
3. Frequency and number of complete oscillations made by an oscillating body in a certain time.
4. Frequency and periodic time.
5. Number of complete oscillations and time taken to complete them.
6. Time of complete oscillation and time of amplitude.

**11. Explain an activity to :**

1. Illustrate the concept of oscillatory motion.
2. Represent the oscillatory motion graphically.

**12. Problems :**

1. Calculate the periodic time of a source that makes 600 oscillations in one minute.
2. Calculate the time of making amplitude of a source that makes 600 oscillations in one minute.



## UNIT

## 1

3. Calculate the frequency of a simple pendulum which makes 720 complete oscillations in 90 seconds.
4. Calculate the number of complete oscillations that are made by a body in 2 minutes if its frequency is 6 Hz.
5. If an oscillating body makes 480 complete oscillations in one minute, calculate :
  - a. Frequency.
  - b. Periodic time.
6. Calculate the frequency of an oscillating body in megahertz, if its periodic time is 0.2 seconds.
7. If the frequency of an oscillating body is 10 Hz, find :
  - a. Its periodic time.
  - b. The time taken to make 300 complete oscillations.
  - c. The number of complete oscillations that this body makes in a minute.

### 13. Study the following figures, then answer the questions :

- (1) Which of the following figures doesn't represent an oscillatory motion ? .....



Fig. (a)



Fig. (b)

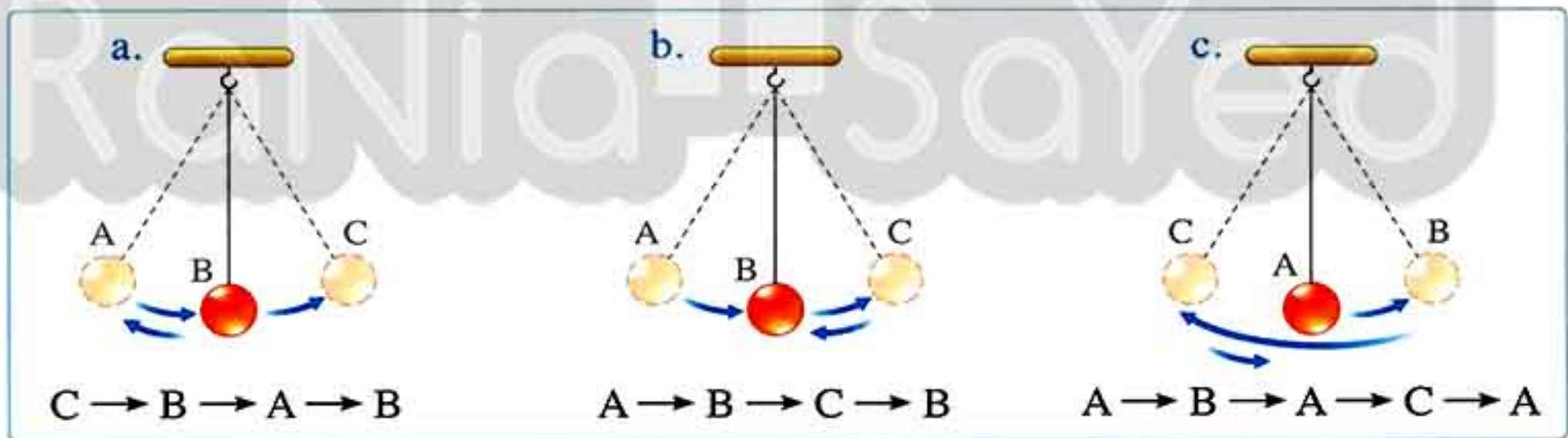


Fig. (c)



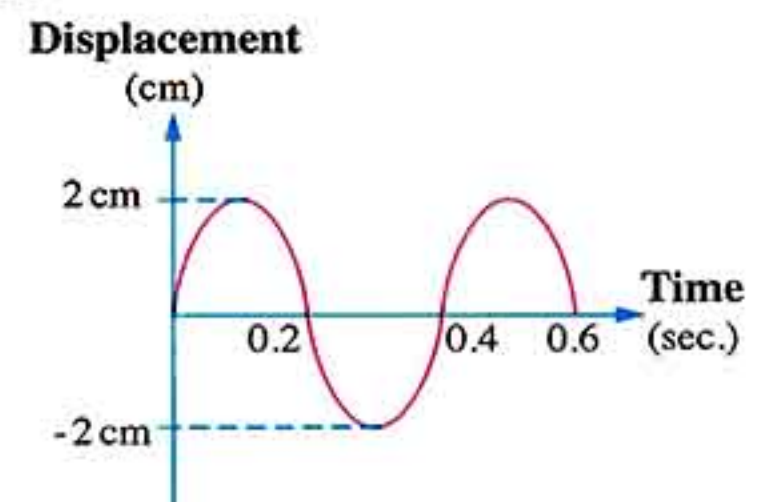
Fig. (d)

- (2) Which of the following figures represents a complete oscillation ? .....



- (3) From the opposite figure, choose the correct answer :

- a. The periodic time = .....  
[0.2 sec. - 0.4 sec. - 0.6 sec. - 0.4 m]
- b. Frequency = .....  
[0.2 sec. - 0.4 Hz - 2.5 cycle/sec. - 0.4 m]
- c. The amplitude = .....  
[0.2 sec. - 0.4 sec. - 2 cm - 0.4 cm]

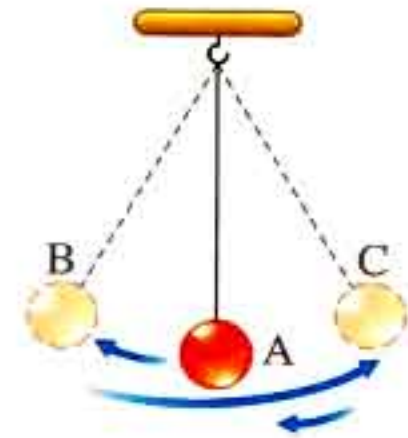




## Lesson One

(4) From the opposite figure, complete :

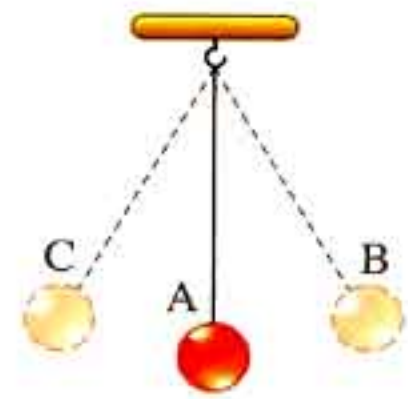
- Point (A) represents .....
- The distance  $\overline{AB}$  represents .....
- The motion of the pendulum  
(A  $\rightarrow$  B  $\rightarrow$  C  $\rightarrow$  A) represents .....  
and the time of this motion is called .....



(5) The opposite figure shows a simple pendulum released from point (B) to move freely.

Complete the following questions :

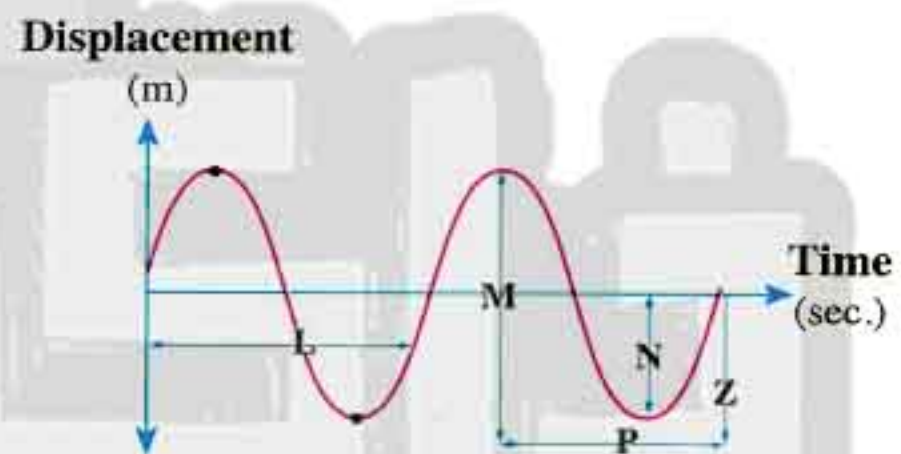
- The oscillating body has its maximum kinetic energy at point(s) .....
- The velocity of the pendulum is minimum at point(s) .....
- If the pendulum takes 0.2 second to move from (A) to (B), so its periodic time is .....



(6) The opposite figure represents an oscillatory motion for a simple pendulum.

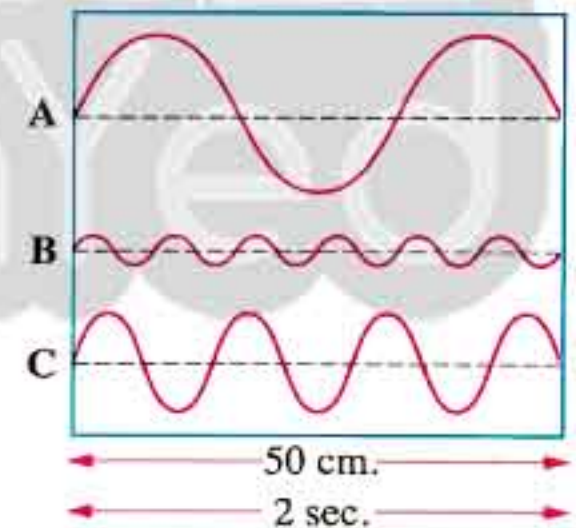
Choose the letter that denotes :

- The oscillation of the pendulum forming  $\frac{3}{4}$  complete oscillation. (.....)
- The amplitude. (.....)

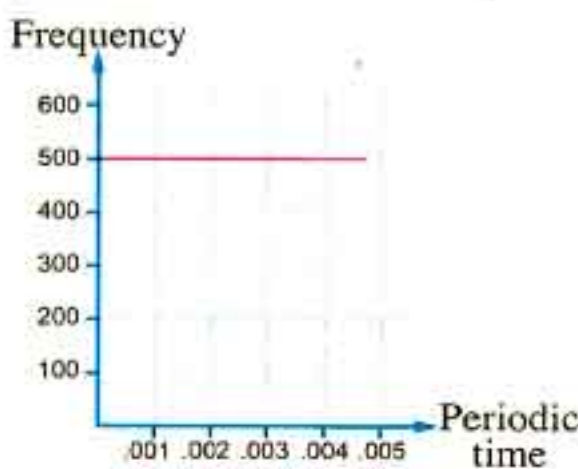


(7) The opposite figure represents three simple harmonic motions (A, B and C), which one has :

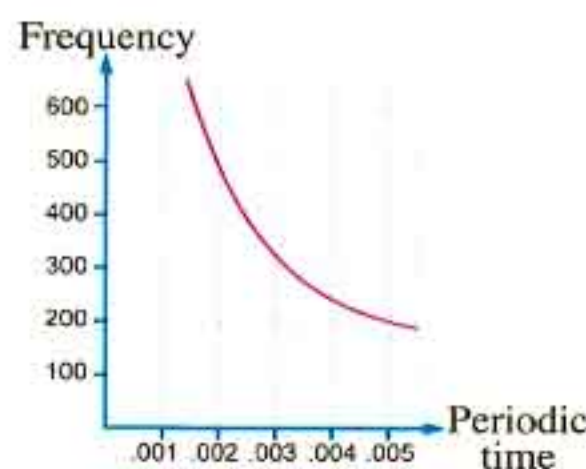
- The largest frequency.
- The largest amplitude.



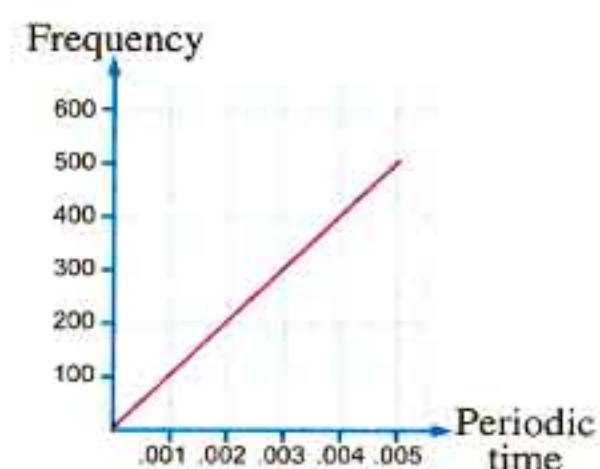
(8) Which of the following graphs expresses the relation between frequency and periodic time ? Why ?



a.



b.



c.



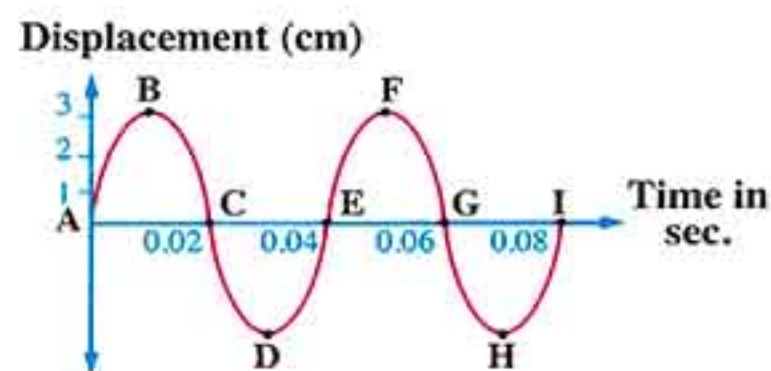
## UNIT

## 1

(9) The opposite figure represents an oscillatory motion.

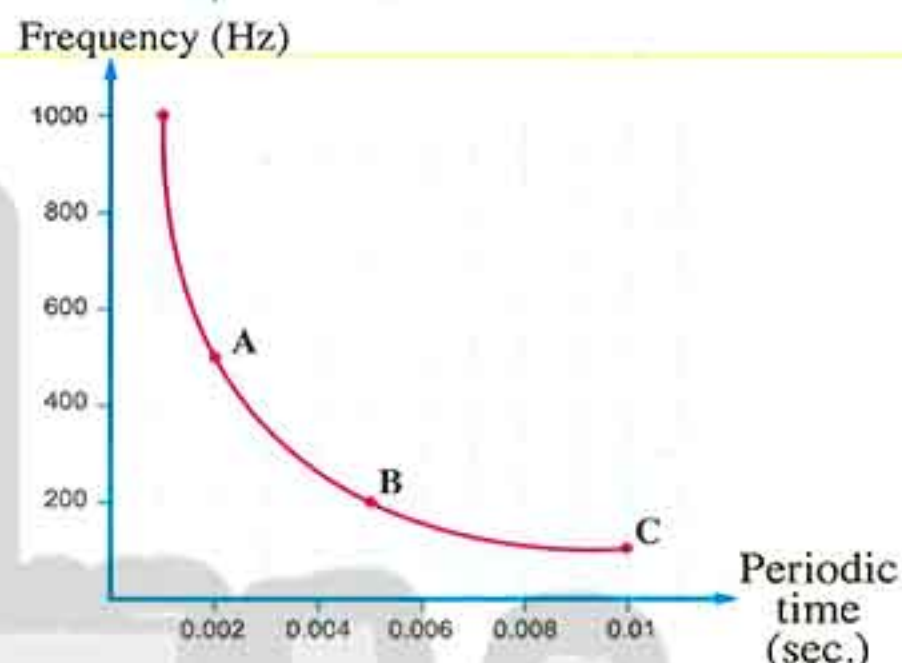
Find :

- The amplitude.
- The periodic time.
- The frequency.



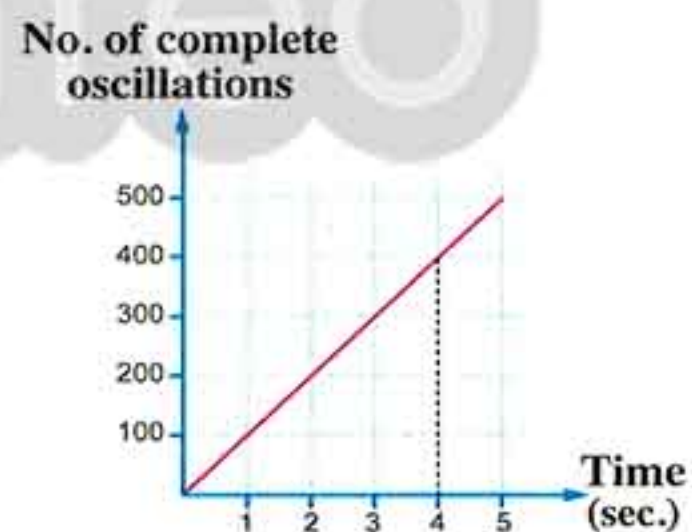
(10) From the opposite figure :

- Determine the number of complete oscillations which made by (A), (B) and (C) in one second.
- Determine the periodic time of the oscillating body (B).
- What is the type of the relation between the frequency and periodic time ?



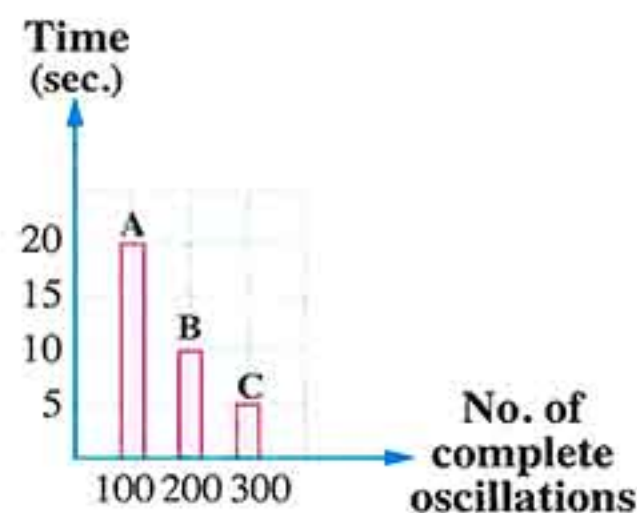
(11) The following graph shows the relation between the number of complete oscillations (N) made by an oscillating body and the time (T) in seconds. From the graph find :

- The number of complete oscillations made by the oscillating body after 4 seconds.
- The time in which the oscillating body makes 200 oscillations.
- The frequency of the oscillating body.
- The periodic time.




(12) The opposite figure indicates the oscillatory motion for three bodies (A) , (B) and (C) :

- Which of these bodies has a very high frequency ?
- What is the value of the periodic time of the body (B) ?

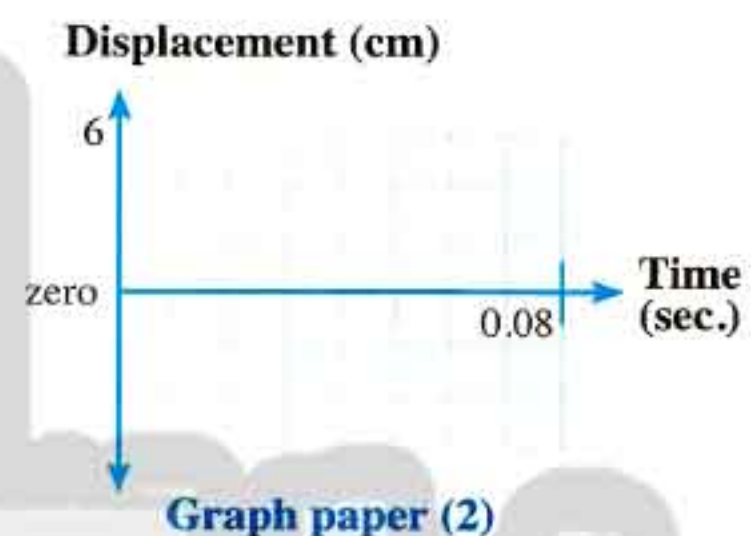
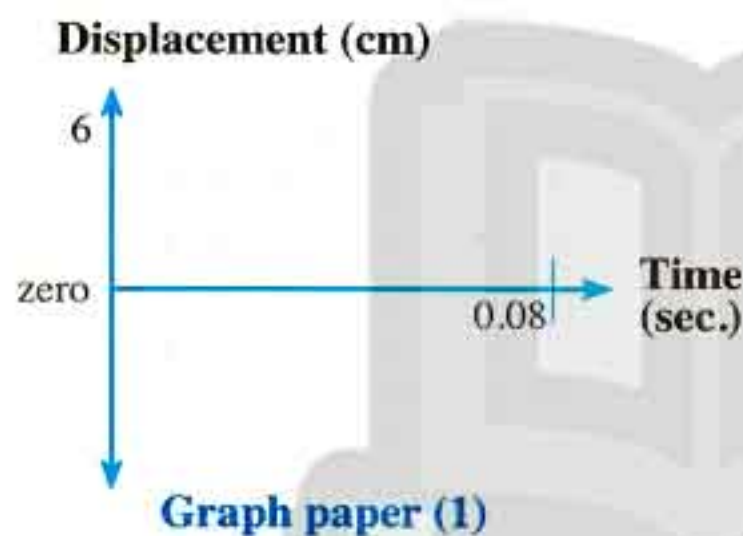
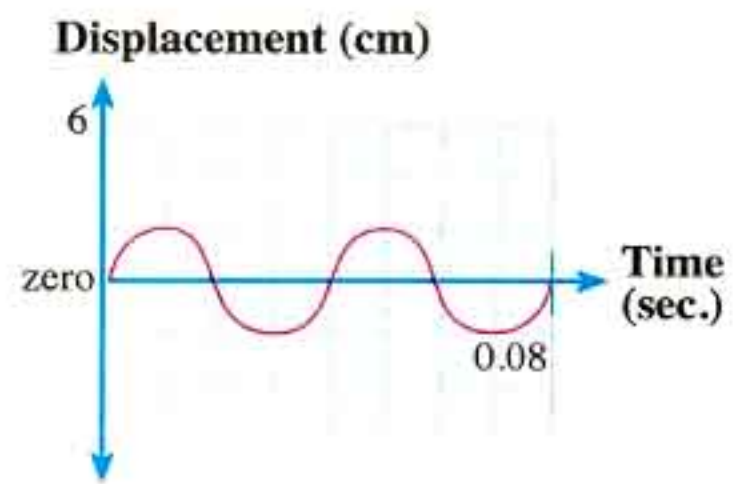




## Lesson One

(13)  The opposite figure represents the motion of an oscillating body. Using the figure :

- Find the periodic time of the oscillating body.
- Redraw the figure in graph paper 1, showing double of the frequency and the same amplitude.
- Redraw the figure in graph paper 2, showing the same frequency and double of the amplitude.



14. When do the following cases happen ?

- The motion of a body is a periodic motion.
- The periodic motion is an oscillatory motion.
- The velocity of a pendulum reaches its maximum value.
- The kinetic energy of a pendulum reaches its minimum value.
- The value of the periodic time of a vibrating body is equal to frequency.

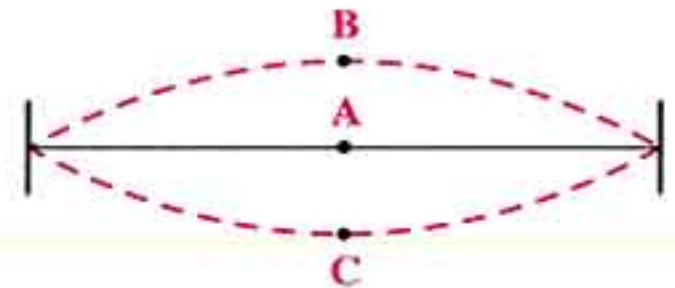


# Timss Questions



## 1. Choose the correct answer :

- In the opposite figure, if the wire transfers from A to B in 5 sec., so its frequency equals to .....  
 a. 5 Hz.  
 b.  $5 \times 10^{-3}$  Megahertz.  
 c.  $5 \times 10^{-9}$  Gigahertz.  
 d.  $5 \times 10^{-5}$  Kiloherztz.
- If the tones of musical scale (do - re - me - fa - sol - la - si) are arranged ascendingly according to frequency so :  
 a. The tone "do" has a periodic time less than the tone "re".  
 b. The tone "re" has a number of oscillations in second less than the tone "me".  
 c. The tone "me" has a periodic time less than the tone "sol".  
 d. The tone "fa" has a frequency higher than the tone "sol".
- The ratio between the time of amplitude to the time of complete oscillation equals .....  
 a. 1 : 2                      b. 2 : 1                      c. 1 : 4                      d. 4 : 1
- The ratio between periodic time of two oscillating bodies the first makes 9 complete oscillations in second and the second makes 3 complete oscillations in second equals .....  
 a.  $\frac{1}{3}$                       b.  $\frac{1}{9}$                       c. 3                      d. 12
- An oscillating body makes 20 complete oscillations in second so its periodic time = ..... sec.  
 a. 0.05                      b. 0.2                      c. 0.1                      d. 5
- If the time of amplitude of an oscillating body is doubled so the time of complete oscillation increases to .....  
 a. double.                      b. 3 times.                      c. 4 times.                      d. 5 times.
- A body makes  $\frac{1}{4}$  complete oscillation in  $\frac{1}{64}$  sec. its frequency = ..... Hertz.  
 a. 256                      b. 64                      c. 16                      d. 4

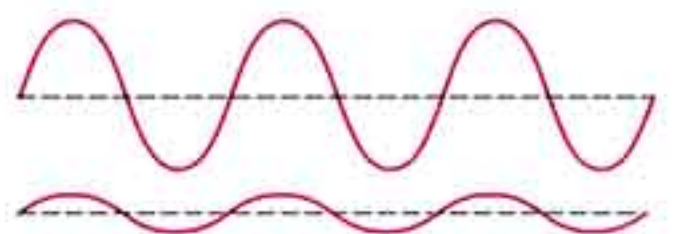


## 2. Simple pendulum makes 1200 complete oscillations in minute where every complete oscillation covers a distance 20 cm. Calculate :

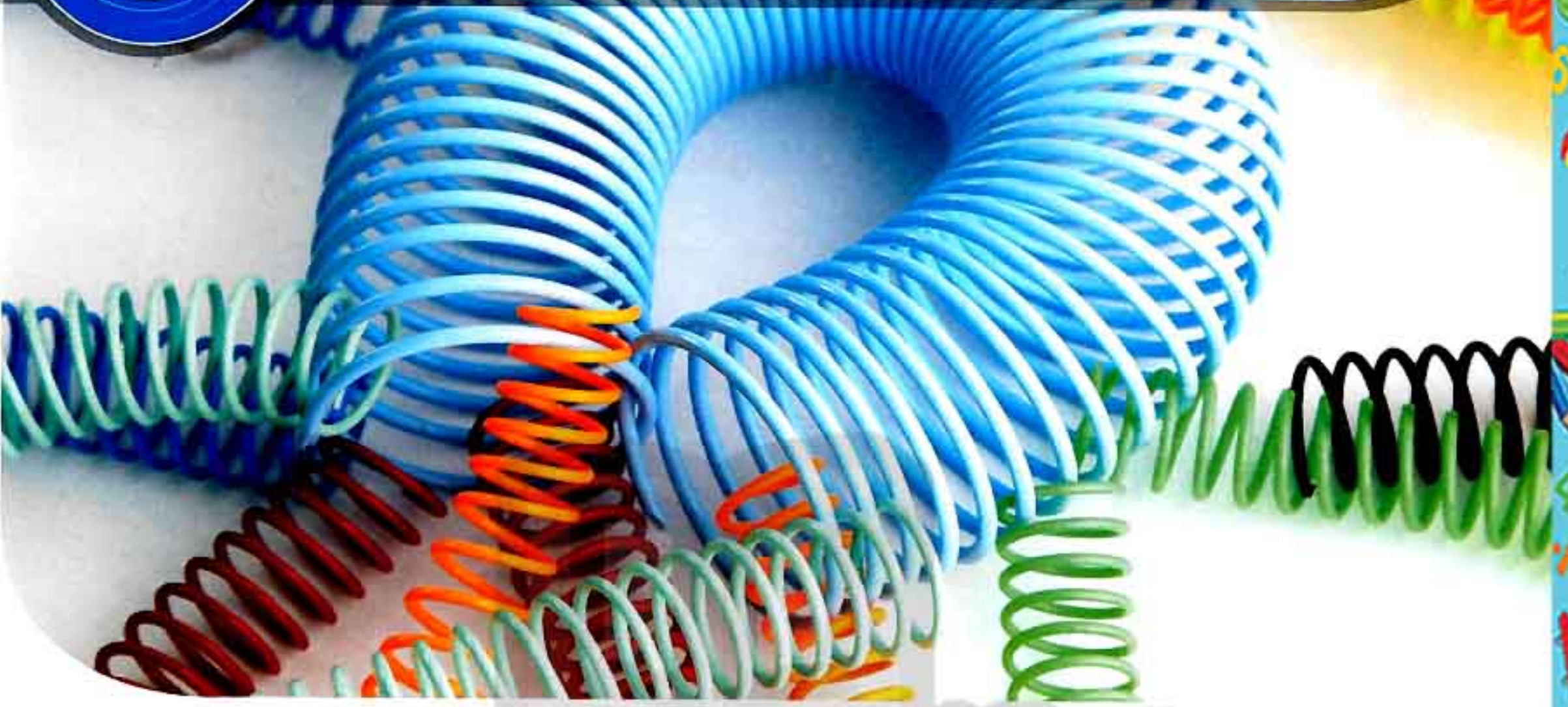
- Amplitude.
- Frequency.
- Periodic time.
- The time of 16 complete amplitude.

## 3. The following figures represent the motion of two oscillating bodies :

- What are the similarities between them ?
- What are the differences between them ?







## What

is meant by waves ?

If you throw a stone in water or when a drop of water collides with a surface of still water, a disturbance will be occurred.

- This disturbance will transfer from a drop to another on the water surface which appears in the form of concentric circles.
- These concentric circles are known as **water waves**.
- The propagation of these circles on the water surface represents **wave motion**.



### ➤ In this lesson, we will study :

1. The role of waves in transferring energy.
2. The concept of wave motion.
3. Types of waves.
4. Some concepts related to wave motion and their properties.



UNIT  
1

To recognize the concept of wave motion, we should know the wave and the role of waves in transferring energy.

1

## The role of waves in transferring energy :



## ACTIVITY

1

Defining the concept of wave and its role in energy transfer :



| ⦿ Procedures   | ⦿ Figure  | ⦿ Observation  |
|--|---|--|
| 1. Arrange the dominoe pieces in a row at equal distances from each other.<br>2. Push the first piece. | <br>Dominoe's pieces | The pieces fall one after the other, as well as they don't change their positions after falling. |



## Explanation :

1. When the first domino piece falls, it will transfer its energy to the second piece, which falls transferring its energy to the third one and so on.
2. The transfer of energy continues and the pieces do not change their positions in the row.



## Conclusion :

The disturbance that **propagates** and **transfers** energy in the direction of propagation is known as **the wave**.

The wave :

It is the disturbance that propagates and transfers energy in the direction of propagation.

## ? Exercise 1

*How do you explain the motion of the coin (Y) when the coin (X) is pushed, though they never touch ?*

- The energy of the first coin (X) is transferred to the second coin which transfers the energy to the third and to the fourth until it reaches the last coin (Y).



(A)



(B)

- The last coin gains energy and does not find another coin to give it this energy, so that it moves away.



2

## The concept of wave motion :



## ACTIVITY 2

Concluding the concept of wave motion :



## Materials and tools :

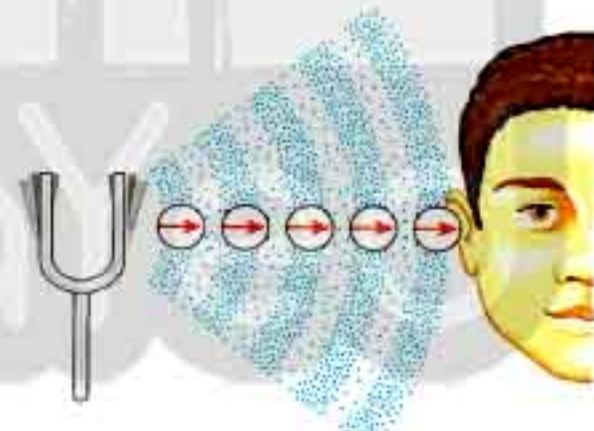
- A hollow glass tube 30 cm long.
- A burning incense stick.
- A candle.
- A tuning fork.

| ⦿ Procedures  | ⦿ Figure | ⦿ Observation  |
|---|----------|--|
| <ol style="list-style-type: none"> <li>1. Fix horizontally the glass tube.</li> <li>2. Put the burning candle at one end of the tube and the incense stick at the other end (as shown in the figure).</li> <li>3. Hit the tuning fork and place it near the incense stick.</li> </ol> |          | <ol style="list-style-type: none"> <li>1. The flame of the candle vibrates.</li> <li>2. Sound waves have transferred energy from the vibrating tuning fork to the candle flame.</li> <li>3. The vapour of burning incense stick does not enter the tube which indicates that air molecules do not move with the sound waves through the tube.</li> </ol> |



## Explanation :

1. Energy is generated when the tuning fork vibrates. This energy is transferred in the form of sound waves. (as shown in the figure).
2. The medium particles (air and smoke particles) do not move from their places during the propagation of sound waves, which carry energy to the candle flame.



Sound waves produced by a tuning fork



## Conclusion :

The movement resulting from the vibration of the medium particles at a certain moment in a specific direction is known as **wave motion**.

So that, **wave motion** can be defined as :

Wave motion :

It is the motion produced as a result of the vibration of the medium particles at a certain moment and in a definite direction.

The line of wave propagation :

It is the direction through which the wave propagates.



## UNIT

## 1

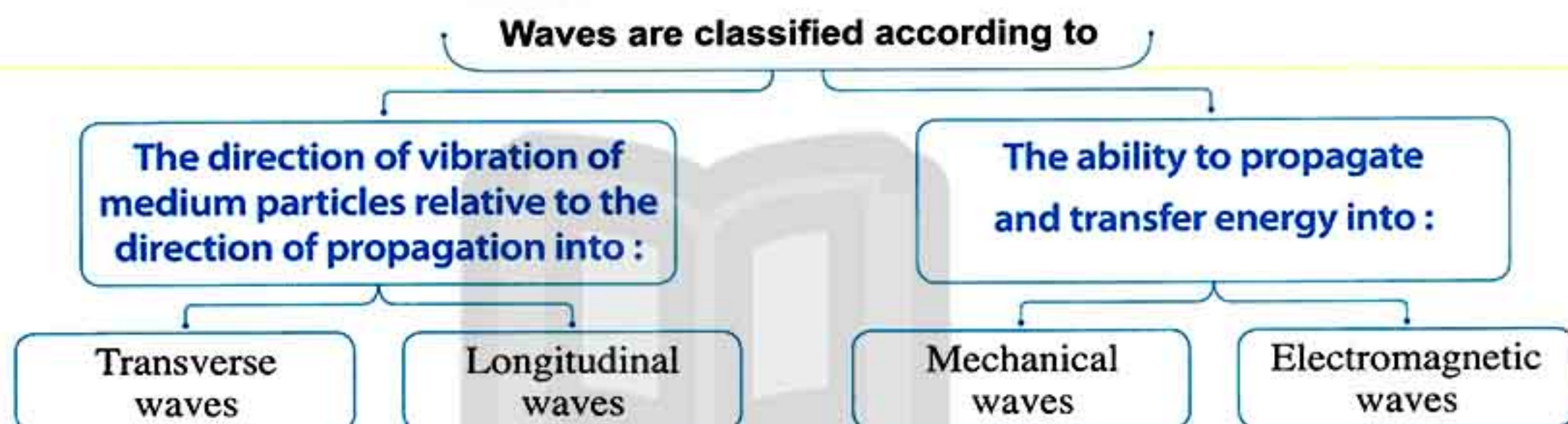
**Remember****In wave motion :**

- Medium particles don't move from their positions, but they vibrate only.
- The wave propagates carrying the energy in the same direction of its propagation.

## 3

**Types of waves :**

Waves are classified according to

**Transverse and longitudinal waves :****ACTIVITY 3**

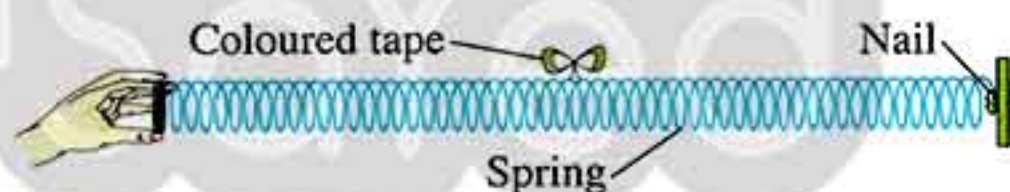
To show the nature of transverse and longitudinal waves :

**Materials and tools :**

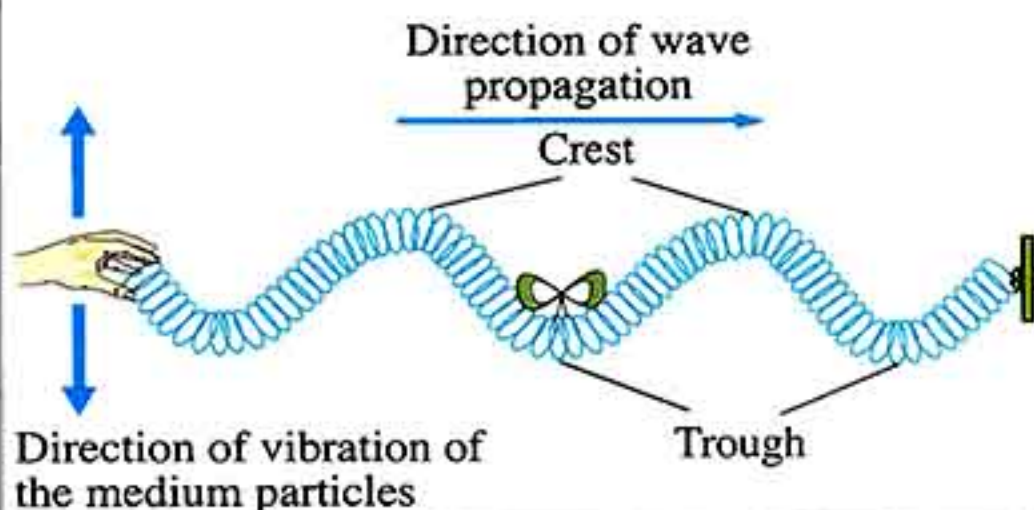
- Spring.
- Coloured tape.
- Nail.

**Procedures :**

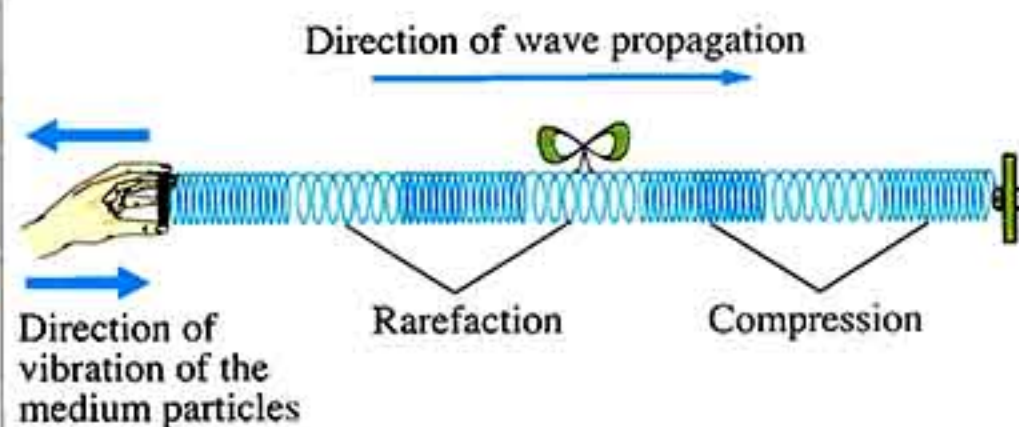
1. Fix one end of the spring to a wall using the nail (as shown in figure).
2. Tie the coloured tape in the middle of the spring.

**⊙ First Case :**

Move the free end of the spring up and down perpendicular to the axis of the spring.

**⊙ Second Case :**

Push and pull the coil rings from the left to the right.





## Lesson Two

## ⊙ Observation

The coloured tape vibrates in its place in a direction perpendicular to the direction of the vibration of rings of spring which move up and down forming crest and trough.

The coloured tape vibrates in its place along the direction of the vibration of rings of spring which are too close to each other in some areas forming compressions and are faraway from each other in some areas forming rarefaction.



## Explanation :

If we considered that the vibration of spring represents wave propagation.

**So :** \* Direction of propagation of rings of spring represents the direction of wave propagation.

\* Direction of vibration of coloured tape represents the direction of medium particles.



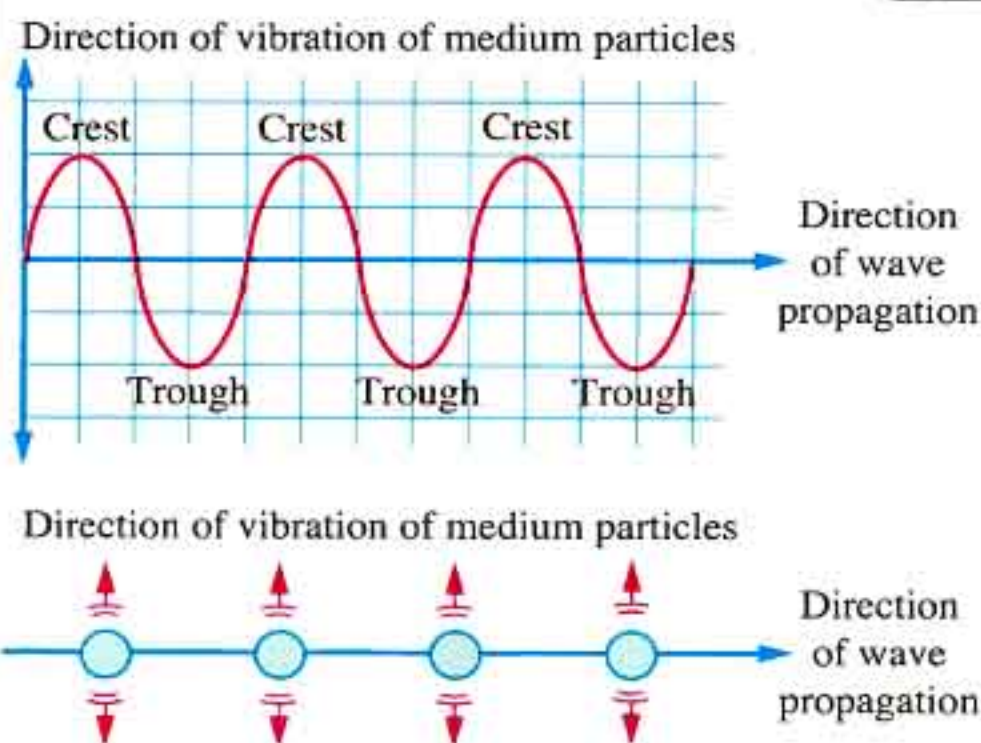
## Conclusions :

- During the wave propagation, the medium particles vibrate around their rest positions without transferring.
- The wave at which the medium particles vibrate in a direction perpendicular to the direction of wave propagation is called transverse waves.
- The wave at which the medium particles vibrate along the direction of wave propagation is called longitudinal waves.

➤ From the previous activity we can compare between transverse and longitudinal waves as following :

## Transverse waves

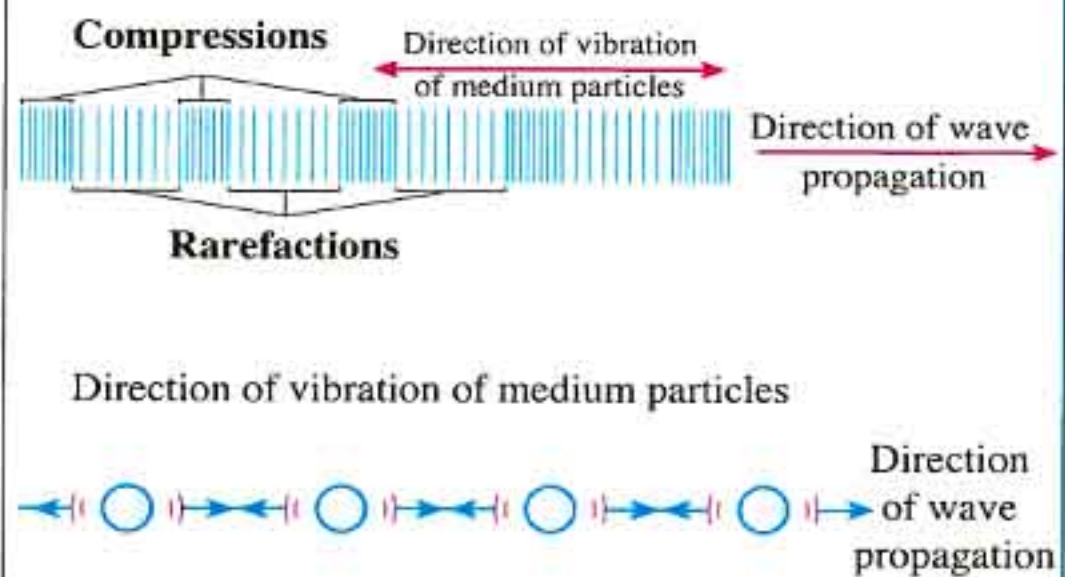
It is a disturbance in which the particles of the medium vibrate perpendicular to the direction of the wave propagation.



## Longitudinal waves

It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation.

## Formation





## UNIT

## 1

It is formed from :  
crest and trough

**Crest :** It is the highest point of the particles of the medium in the transverse wave.

**Trough :** It is the lowest point of the particles of the medium in the transverse wave.

It is formed from :  
compression and rarefaction.

**Compression :** It is the area in the longitudinal wave at which the particles of the medium are of the highest density and pressure.

**Rarefaction :** It is the area in the longitudinal wave at which the medium particles are of the lowest density and pressure.

## Examples

Water waves

Sound waves

GR

- **Water waves are transverse waves.**

Because the water particles vibrate in a direction perpendicular to the direction of waves propagation.

- **Sound waves are longitudinal waves.**

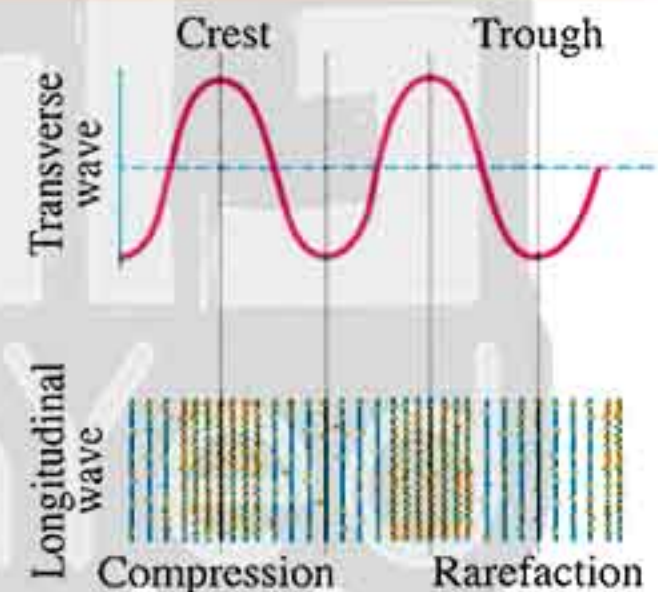
Because the medium (air) particles vibrate along the direction of waves propagation.

NB

- **Crest** = **Compression**  
(in transverse wave) (in longitudinal wave)

Similarly :

- **Trough** = **Rarefaction**  
(in transverse wave) (in longitudinal wave)



## Real Life application : Physiotherapy tubs (Jacuzzi)

### Idea of work

- Jacuzzi is a tub where water moves in the form of circular waves.



### Uses of Jacuzzi

- It is used to treat :
  1. Sprains and cramps by using hot water.
  2. Nervous tension by using cold water.





**Electromagnetic and mechanical waves :**

1

**Electromagnetic waves****Electromagnetic waves :**

They are a type of waves, which have the ability to propagate through vacuum with a great velocity.

**Properties :**

- They do not need a medium to propagate.
- They propagate through vacuum (free space).
- They are all transverse waves.
- They propagate by a velocity  $= 3 \times 10^8$  m/sec. in vacuum but their velocity decreases when they transfer in media.

**Examples :**

- Light waves.
- Infrared waves.
- Radio waves (used in radars).



2

**Mechanical waves****Mechanical waves :**

They are a type of waves that can't propagate through vacuum, but can transfer through different media with different low velocities.

**Properties :**

- They need a medium to propagate.
- They do not propagate through vacuum (free space).
- They are transverse waves or longitudinal waves.
- They propagate with a velocity is much less than the velocity of electromagnetic waves in media.

**Examples :**

- Water waves (transverse waves).



- Sound waves (longitudinal waves).





## UNIT

## 1

## GR.

- **We can't hear the sound of solar explosions occurring on the Sun, but we can see the light coming out of it.**

Because the sound is mechanical waves, which need a medium to propagate through, while the light is electromagnetic waves, which can propagate through vacuum.

- **Hearing thunder after seeing lightning although they both happen at the same time.**

Because the light of lightning is from **electromagnetic waves**, while the sound of thunder is **mechanical waves**, where the speed of electromagnetic waves is much greater than the speed of mechanical waves.

- **Water waves and sound waves are mechanical waves.**

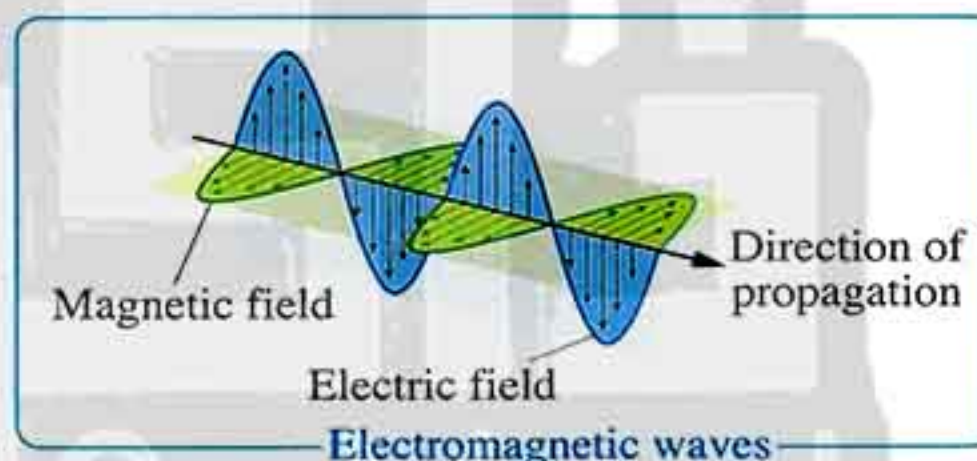
Because they need a medium to propagate through.

- **Light waves and radio waves are electromagnetic waves.**

Because they don't need a medium to propagate through.

## ► Enrichment information

- *Electromagnetic waves are a type of transverse waves that can propagate in free space.*
- *They consist of electric field and a magnetic field perpendicular to each other and to the direction of wave propagation.*



## ❓ Questions ( Choose :

- ..... is / are mechanical waves.
  - Water wave only
  - Sound wave only
  - Microwave only
  - Both (a) and (b)
- Radio waves .....
  - are transverse mechanical waves.
  - are longitudinal waves.
  - propagate through vacuum.
  - need a medium to propagate through.
- All of the following are electromagnetic waves except ..... waves.
  - light
  - sound
  - infrared
  - radio

## ✔ Answer

1. d

2. c

3. b

TRY

TO ANSWER worksheet  
in the Notebook

3



4

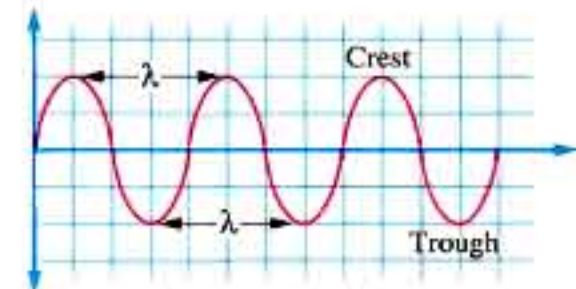
**Some concepts related to wave motion and its properties :**

1. Wavelength.
2. Amplitude.
3. Wave velocity.
4. Wave frequency.

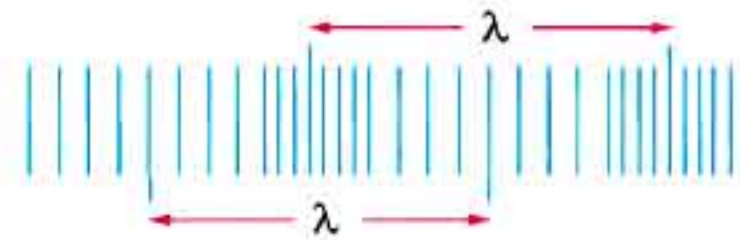
1

**Wavelength ( $\lambda$ ) :****The wavelength ( $\lambda$ ) of the transverse wave :**

It is the distance between two successive crests or troughs.

**The wavelength ( $\lambda$ ) of the longitudinal wave :**

It is the distance between the centres of two successive compressions or rarefactions.



- The measuring unit of wavelength ( $\lambda$ ) is "metre".

**⇒ Laws used for determination the wavelength ( $\lambda$ ) :**

1. Wavelength of a transverse wave

=

$2 \times$  the horizontal distance between the successive crest and trough.

2. Wavelength of a longitudinal wave

=

$2 \times$  the distance between the centres of successive compression and rarefaction.

3. Wavelength

=

$\frac{\text{The distance which covered by waves}}{\text{Number of waves}}$

**? Exercise (2)**

*Determine the wavelength of the following :*

1. A transverse wave, the distance between its successive crest and trough = 5 metre.
2. A longitudinal wave, the distance between its first compression and third compression = 15 metre.

**✓ Answer**

1. Wavelength =  $2 \times$  the horizontal distance between the successive crest and trough  
 $= 2 \times 5 = 10$  metre

2.  $\therefore$  Number of waves = 2

$$\therefore \text{Wavelength} = \frac{\text{The distance covered by waves}}{\text{Number of waves}} = \frac{15}{2} = 7.5 \text{ metre}$$



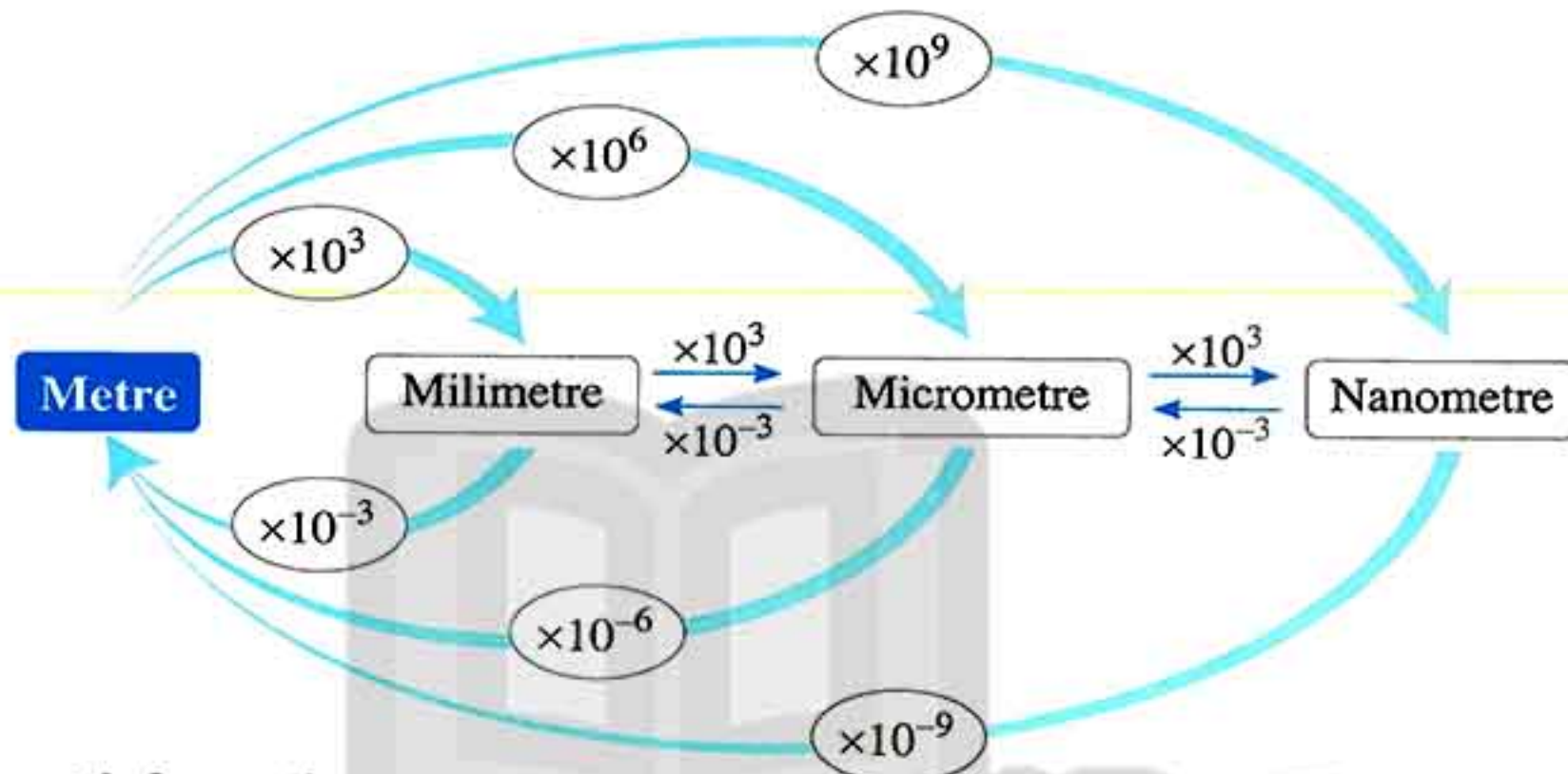
## UNIT

## 1

**Fractions of a metre :**

- Milimetre (mm).
- Micrometre.
- Nanometre.

The following chart shows the conversions of these fractions :

**► Enrichment information**

The wavelength of some electromagnetic waves is :

- Visible light 380 : 700 nanometres
- Infrared rays  $10^3$  :  $10^6$  nanometres
- Microwaves  $10^6$  :  $10^9$  nanometres

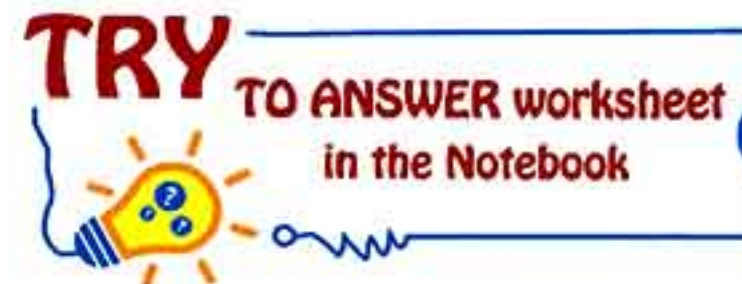
**? What is meant by ?**

The wavelength of a transverse wave is 10 cm ?

- ➔ This means that the distance between two successive crests or two successive troughs in such wave is 10 cm.

The wavelength of a longitudinal wave is 20 cm ?

- ➔ This means that the distance between the centres of two successive compressions or two successive rarefactions in such wave is 20 cm.



## 2

**Amplitude :****The amplitude of the wave :**

It is the maximum displacement achieved by the medium particles away from their rest positions.

- The measuring unit of amplitude is "metre" or "centimetre".



## Lesson Two

## ➤ Law used for determination the amplitude :

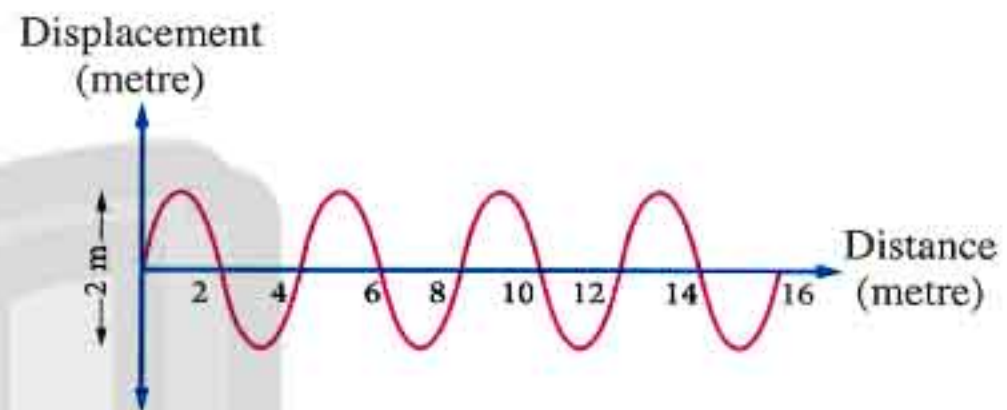
∴ The vertical distance between the crest and the trough of a wave =  $2 \times \text{Amplitude}$

$$\therefore \text{Amplitude} = \frac{\text{The vertical distance between the crest and the trough of a wave}}{2}$$

## ❓ Exercise 3

From the opposite figure, determine :

1. Amplitude.
2. Wavelength.



## ✓ Answer

$$1. \text{Amplitude} = \frac{\text{The vertical distance between the crest and the trough of a wave}}{2} = \frac{2}{2} = 1 \text{ metre.}$$

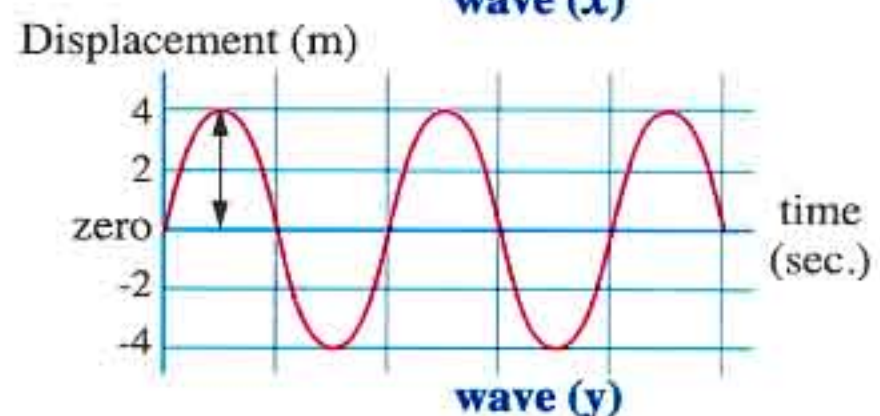
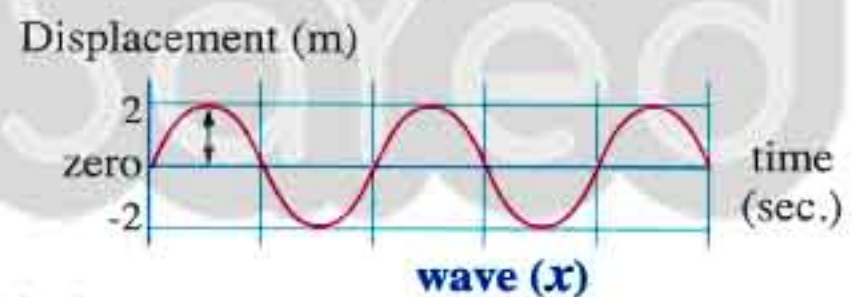
$$2. \text{Wavelength} = \frac{\text{The distance covered by waves}}{\text{Number of waves}} = \frac{16}{4} = 4 \text{ metre.}$$

## ❓ Exercise 4

Compare between the amplitudes of both waves (x) and (y) shown in the figure.

## ✓ Answer

- Amplitude of wave (y) is larger than that of wave (x).
- Amplitude of wave (y) = 4 m
- Amplitude of wave (x) = 2 m



## ❓ What is meant by ?

**Amplitude of a mechanical wave is 3 cm.**

- The maximum displacement achieved by the medium particles away from their rest positions is 3 cm. (0.03 m).



## UNIT

## 1

## 3

## The wave velocity (V) :

Wave velocity (V) :

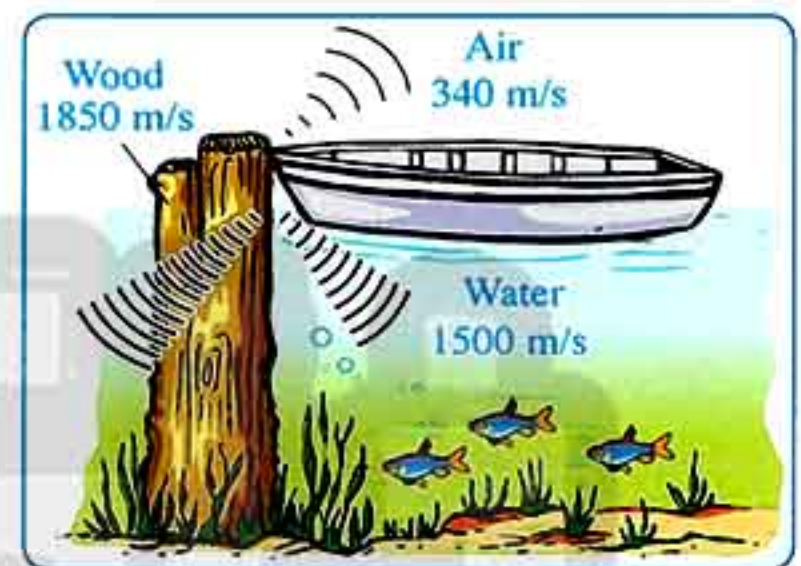
It is the distance covered by the wave in one second.

- The measuring unit of wave velocity is "metre per second (m/s)".

⇒ Wave velocity can be determined by the relation :

$$\text{Wave velocity (V)} = \frac{\text{Distance covered by the wave in metres (m)}}{\text{Time in seconds (s)}}$$

- Wave velocity represents the velocity of the transfer of the energy carried by the wave.
- Wave velocity is constant through the same medium, but it changes from one medium to another, as follows :
- The velocity of sound waves through air = 340 m/s
- The velocity of sound waves through water = 1500 m/s
- The velocity of sound waves through wood = 1850 m/s



Different sound speeds through different media

### ? What will happen if ?

Sound waves transfer from air to water.

⇒ The velocity of sound waves will increase.

The distance, which is covered by a wave in water through one minute =  $9 \times 10^4$  metre.

⇒ This means that the wave velocity = 1500 m/s

Which can be calculated by the following law :

$$V = \frac{9 \times 10^4}{60} = 1500 \text{ m/s}$$

i.e.

The velocity of sound through solids > The velocity of sound through liquids > The velocity of sound through gases (air)



## Lesson Two

4

**Wave frequency (F) :**

As we have learned from the first lesson, the frequency of an oscillating (vibrating) body, Now, we can define the frequency of the wave as follows :

**Wave frequency :**

It is the number of waves produced from the source in one second.

- The measuring unit of frequency is "**Hertz**".

**Wave frequency can be determined by the relation :**

$$\text{Wave frequency} = \frac{\text{Number of produced waves}}{\text{Time in seconds (s)}}$$

Similarly, 
$$\text{Periodic time of the wave (T)} = \frac{1}{\text{Frequency (F)}}$$

NB

- The periodic time of the wave is the time of one wave.

**► Enrichment information**

- The tide waves, which are known as Tsunami waves have wavelength = 200 km., amplitude = 30 m. and move with velocity = 800 km/hour.
- A glass cup is shattered when its natural frequency is equivalent to the frequency of a nearby sound source, as the amplitude of the oscillation of the cup particles becomes too large. This phenomenon is known as **Resonance**.

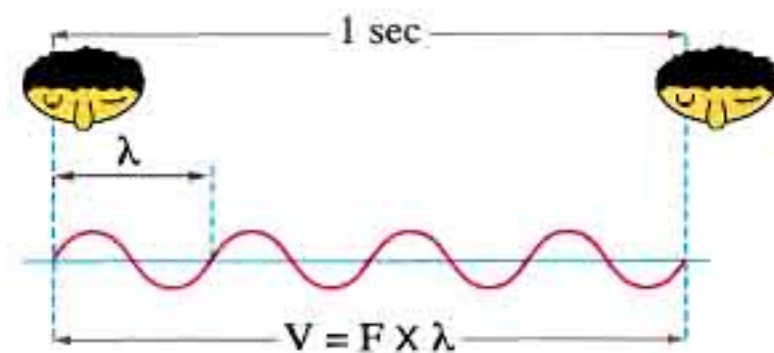


Glass cup

**Law of wave propagation :**

It is the relation between the wave velocity (V), its frequency (F) and wavelength ( $\lambda$ ) in the wave motion.

From the figure :



The distance covered by the wave in one second = Number of waves produced in one second  $\times$  Wavelength

Therefore 
$$\text{Wave velocity (V)} = \text{Frequency (F)} \times \text{Wavelength } (\lambda)$$
  
Metre/second      Hertz      Metre



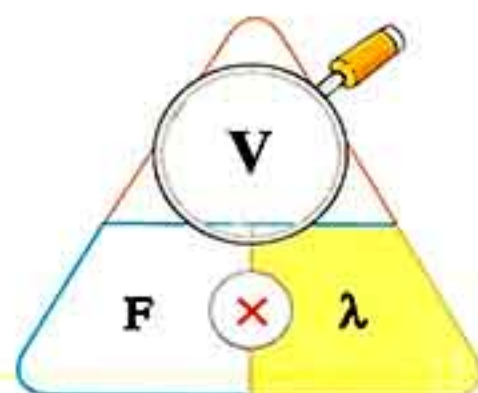
## UNIT

1



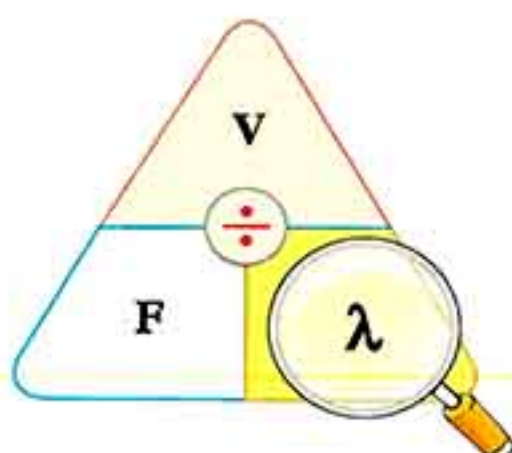
To calculate the wave velocity, wavelength and frequency :

Wave velocity



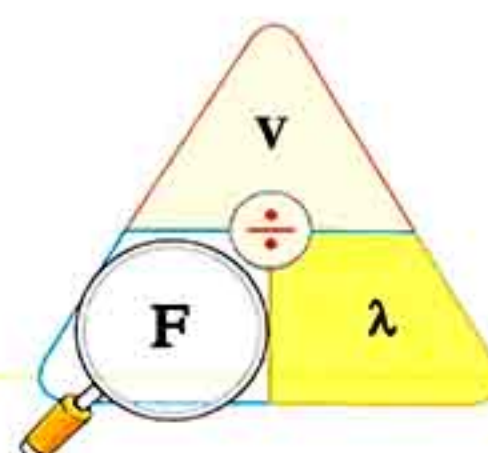
$$V = F \times \lambda$$

Wavelength



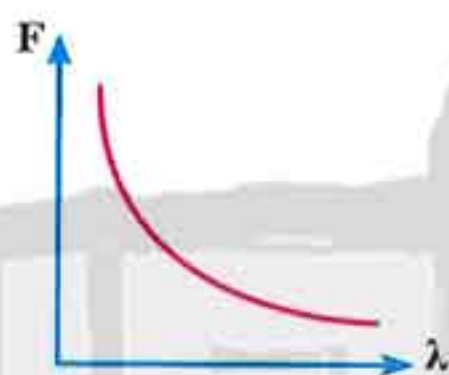
$$\lambda = \frac{V}{F}$$

Frequency



$$F = \frac{V}{\lambda}$$

## Notice that



- Frequency (F) is inversely proportional to wavelength (λ) in the same medium.



- Wave velocity is directly proportional to frequency (F) at constant wavelength (λ).



- Wave velocity (V) is directly proportional to wavelength (λ) at constant frequency (F).

GR.

**The wave velocity of light and radio waves is the same although their frequency is different.**

Because each of them is an electromagnetic wave so, the multiplying of frequency and wave length of each of them = constant value =  $3 \times 10^8$  m/s

### ? Exercise 5

Calculate the wavelength in metre for a visible light wave of frequency  $5 \times 10^{14}$  Hertz and velocity of  $3 \times 10^8$  m/s.

### ✓ Answer

$$\begin{aligned} \text{Wavelength } (\lambda) &= \frac{\text{Wave velocity (V)}}{\text{Frequency (F)}} \\ &= \frac{3 \times 10^8}{5 \times 10^{14}} = 0.6 \times 10^{-6} = 6000 \times 10^{-10} \text{ metre} \end{aligned}$$



## Lesson Two

# Problems

- 1 A longitudinal wave is produced by a spiral spring where the distance between the first and the fourth rarefactions is 18 cm.

Find the wave velocity if the frequency of such wave is 20 Hertz.

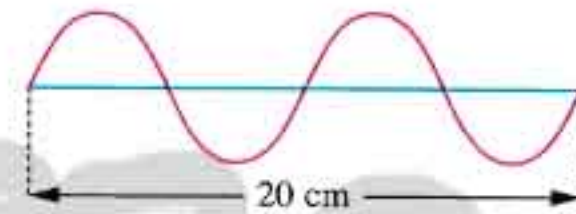
## Solution

3 waves are formed between the first and fourth rarefactions.

$$\therefore \text{Wavelength } (\lambda) = \frac{18}{3} = 6 \text{ cm} = 0.06 \text{ m.}$$

$$\therefore \text{Wave velocity (V) = Wavelength } (\lambda) \times \text{Wave frequency (F)} \\ = 0.06 \times 20 = 1.2 \text{ m/sec.}$$

- 2 From the opposite figure, calculate the velocity of the wave if its frequency is 25 Hertz.



## Solution

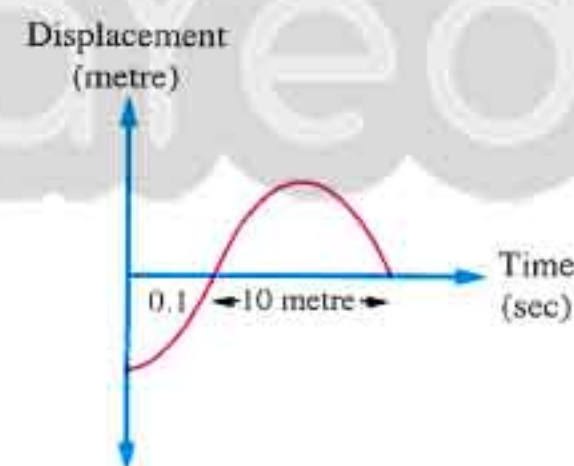
The figure shows two waves of length 20 cm.

$$\therefore \text{The wavelength } (\lambda) = \frac{20}{2} = 10 \text{ cm} = 0.1 \text{ m.}$$

$$\therefore \text{Wave velocity (V) = Wavelength } (\lambda) \times \text{Wave frequency (F)} \\ = 0.1 \times 25 = 2.5 \text{ m/sec.}$$

- 3 From the opposite figure, calculate :

1. The number of waves in the figure.
2. The wave velocity.



## Solution

$$1. \text{ The number of waves} = \frac{3}{4} \text{ wave.}$$

$$2. \therefore \text{Periodic time (T) = } 4 \times 0.1 = 0.4 \text{ sec.}$$

$$\text{Frequency} = \frac{1}{\text{periodic time}} = \frac{1}{0.4} = 2.5 \text{ Hz}$$

$$\text{Wavelength } (\lambda) = 2 \times \text{the horizontal distance between the successive crest and trough.}$$

$$= 2 \times 10 = 20 \text{ metre.}$$

$$\therefore \text{Wave velocity (V) = Frequency} \times \text{Wavelength} \\ = 2.5 \times 20 = 50 \text{ m/s.}$$



## UNIT

## 1

## ➔ Comparison between oscillatory (vibrational) motion and wave motion :

| Points of comparison   | Oscillatory motion  | Wave motion   |
|------------------------|---|---|
| <b>Definition :</b>    | - It is the motion of the oscillating body around its rest point, where the motion is repeated through equal intervals of time.               | - It is the motion produced as a result of the vibration of the medium particles at a certain moment and in a definite direction. |
| <b>Amplitude :</b>     | - The maximum displacement of the oscillating body away from its rest position.   | - The maximum displacement achieved by the medium particles away from their rest positions.                                       |
| <b>Frequency :</b>     | - The number of complete vibrations made by the vibrating body in one second.   | - The number of waves produced by the wave source in one second.  |
| <b>Periodic time :</b> | - It is the time of one complete vibration.   | - It is the time of one wave.   |
| <b>Velocity :</b>      | - The velocity is maximum when the oscillating body passes its rest position and decreases gradually when it goes far from its rest position. | - The velocity is constant through the same medium, but it changes from one medium to another.                                    |
| <b>Examples :</b>      | - Pendulum's motion.<br>- Motion of spiral spring.  | - Sound waves as mechanical longitudinal waves.<br>- Light waves as electromagnetic transverse waves.                             |

TRY

TO ANSWER worksheet

5

- General Exercise of the School Book on Unit 1
- Model Exams on Unit 1 in the Notebook



استمتع بمشاهدة شرح الدروس والتجارب و الأنشطة  
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# Remember



★ **The wave :**

It is the disturbance that propagates and transfers energy in the direction of propagation.

★ **Wave motion :**

It is the motion produced as a result of the vibration of the medium particles at a certain moment and in a definite direction.

★ **The line of wave propagation :**

It is the direction, through which the wave propagates.

★ **Transverse wave :**

It is a disturbance, in which the particles of the medium vibrate perpendicular to the direction of the wave propagation.

★ **Crest :**

It is the highest point of the particles of the medium in the transverse wave.

★ **Trough :**

It is the lowest point of the particles of the medium in the transverse wave.

★ **Longitudinal wave :**

It is a disturbance, in which the particles of the medium vibrate along the direction of wave propagation.

★ **Compression :**

It is the area in the longitudinal wave, at which the particles of the medium are of the highest density and pressure.

★ **Rarefaction :**

It is the area in the longitudinal wave, at which the medium particles are of the lowest density and pressure.

★ **The wavelength ( $\lambda$ ) of the transverse wave :**

It is the distance between two successive crests or troughs.

★ **The wavelength ( $\lambda$ ) of the longitudinal wave :**

It is the distance between the centres of two successive compressions or rarefactions.

★ **The amplitude of the wave :**

It is the maximum displacement achieved by the medium particles away from their rest positions.

★ **Wave velocity :**

It is the distance covered by the wave in one second.

★ **Wave frequency :**

It is the number of waves produced from the source in one second.

★ **Wave velocity (V) = Frequency (F)  $\times$  Wavelength ( $\lambda$ )**



# Questions

## on lesson two

Questions signed by  have been taken from the school book.

### 1. Choose the correct answer :

1. Wave is the disturbance that propagates and transfers energy .....

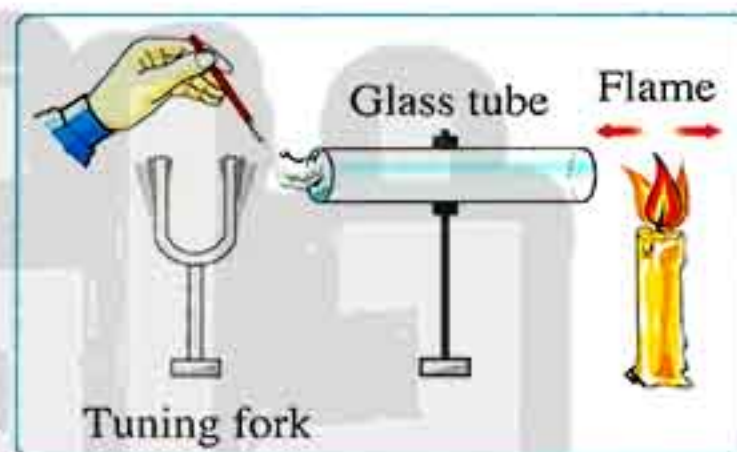
- in the direction of propagation.
- in a direction opposite to that of propagation.
- in a direction perpendicular to that of propagation.
- no correct answer.

2. In wave motion, .....

- medium particles move.
- the waves move carrying the energy.
- medium particles vibrate without transferring from their places.
- (b) and (c) are correct.

3. When hitting a tuning fork, the particles of air in touch with it .....

- don't move.
- vibrate perpendicular to the direction of wave propagation.
- vibrate in the direction of wave propagation with changing their places.
- vibrate in the direction of wave propagation without changing their places.



4. All of the following are the properties of mechanical waves except .....

- they are longitudinal or transverse waves.
- they don't propagate through vacuum.
- they don't need a medium to propagate through.
- water and sound waves are examples of these waves.

5. .... is (are) mechanical waves.

- Water wave only
- Sound wave only
- Microwave only
- Both (a) and (b)

6. Radio waves .....

- are transverse mechanical waves.
- are longitudinal waves.
- propagate through vacuum.
- need a medium to propagate through.

7. All of the following are electromagnetic waves except ..... waves.

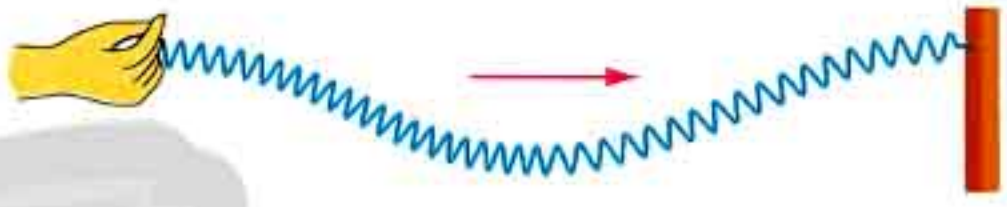
- light
- sound
- microwaves
- radio

8. If the light speed is compared with the sound speed, which of these statements is correct ? .....

- Light speed equals sound speed.
- Light speed is higher than sound speed.
- Light speed is lower than sound speed.
- There is no correct answer.



## Lesson Two

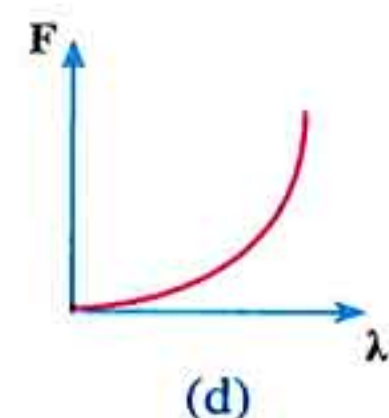
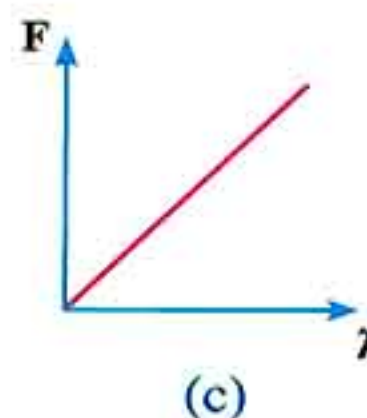
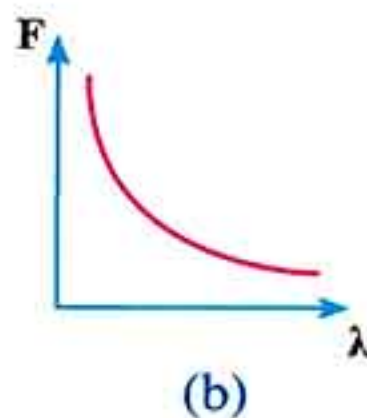
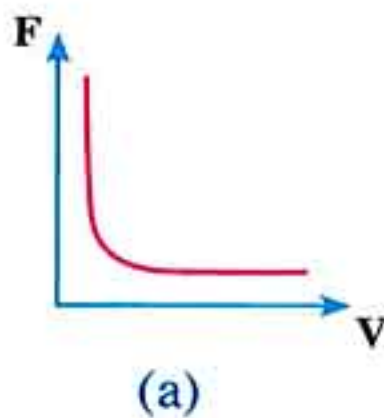
9. Transverse wave consists of .....  
 a. compressions and rarefactions.      b. troughs and rarefactions.  
 c. compressions and crests.      d. crests and troughs.
10. The longitudinal wave consists of .....  
 a. compressions and rarefactions.      b. troughs and rarefactions.  
 c. compressions and crests.      d. crests and troughs.
11.  In the opposite figure, the particles of the medium (the coil) vibrate .....  
 a. to the right only.  
 b. upwards only.  
 c. to right and left.  
 d. upwards and downwards.
12. Water waves are transverse waves because the particles of the medium .....  
 a. vibrate perpendicular to the direction of wave propagation.  
 b. do not vibrate.  
 c. don't need a medium to propagate through.  
 d. vibrate along the direction of wave propagation.
13. All of the following are transverse waves except ..... waves.  
 a. water      b. light      c. sound      d. radio
14. The electric bell produces pulses of .....  
 a. compressions and rarefactions.      b. crests and troughs.  
 c. crests and rarefactions.      d. compressions and troughs.
15. Scientists saw the explosions that occur on the Sun surface, but they couldn't record the sound of these explosions because the sound .....  
 a. doesn't travel from up to down.  
 b. needs a medium to travel through.  
 c. is mechanical waves that propagate in definite direction.  
 d. is electromagnetic waves that don't propagate through free space.
16. Sound waves are longitudinal waves because the particles of the medium .....  
 a. don't need a medium to propagate through.  
 b. don't vibrate.  
 c. vibrate along the direction of wave propagation.  
 d. vibrate in a direction perpendicular to the direction of wave propagation.
17. The highest point of the particles of the medium in the transverse wave is known as .....  
 a. the crest.      b. the compression.      c. the rarefaction.      d. the trough.
18. Rarefaction is the area of the medium, at which the medium particles .....  
 a. don't vibrate.      b. are too close to each other.  
 c. are faraway from each other.      d. vibrate up and down.



## UNIT

## 1

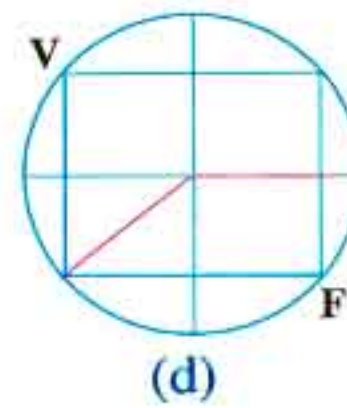
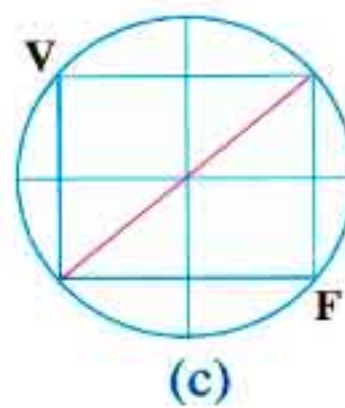
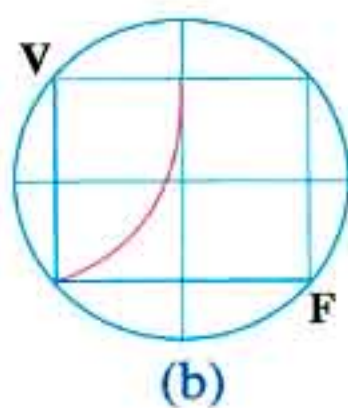
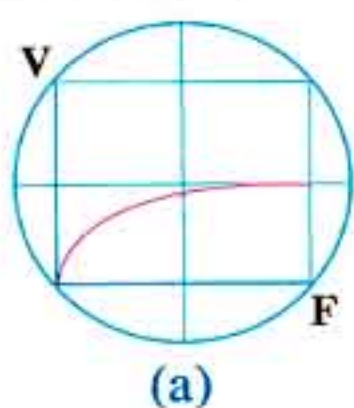
19. Jacuzzi is a tub of physiotherapy where water moves in the form of ..... waves.  
a. circular                      b. longitudinal                      c. oval                      d. no correct answer
20. The distance between two successive crests or two successive troughs in the transverse wave is .....  
a. wavelength.                      b. wave velocity.                      c. amplitude.                      d. frequency.
21. The distance between the centres of the second and the fourth compressions is .....  
a. the wavelength of longitudinal wave.  
b. double the wavelength of longitudinal wave.  
c. double the wavelength of transverse wave.  
d. four times the wavelength of longitudinal wave.
22. If the distance between the centre of the third compression and that of the fifth compression on the wave propagation is 20 cm., the wavelength of this wave is .....  
a. 40 cm.                      b. 20 cm.                      c. 10 cm.                      d. 5 cm.
23. .... is the maximum displacement of medium particles away from its rest position.  
a. Wavelength                      b. Frequency of the wave  
c. Amplitude of the wave                      d. Wave velocity
24. .... is the measuring unit of wave velocity.  
a. Metre                      b. Metre/second                      c. Second                      d. Hertz
25. Velocity of sound waves through air = ..... m/s.  
a. 1850                      b. 1500                      c.  $3 \times 10^8$                       d. 340
26. Sound velocity is the greatest through .....  
a. vacuum.                      b. solids.                      c. liquids.                      d. gases.
27. The distance that is covered by the wave in one second is called .....  
a. wave velocity.                      b. wave frequency.                      c. wavelength.                      d. no correct answer.
28. The periodic time of a tuning fork which makes 240 waves in one minute equals .....  
a. 1 sec.                      b. 4 sec.                      c.  $\frac{1}{2}$  sec.                      d.  $\frac{1}{4}$  sec.
29. The mathematical relation between the velocity and wavelength is .....  
a. velocity = frequency  $\times$  wavelength.                      b. velocity = wavelength / frequency.  
c. wavelength = frequency / velocity.                      d. no correct answer.
30. The graph (.....) represents the relation between frequency (F) and wavelength ( $\lambda$ ) for a wave which moves in the same medium.





## Lesson Two

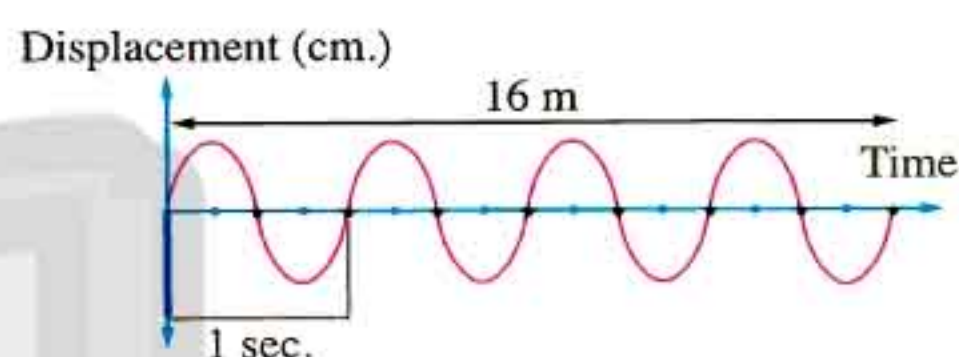
31. Graph ..... represents the relation between frequency and wave velocity at constant wavelength.



32. From the opposite figure :

Wave frequency and velocity are .....

- a. (16 , 4).                      b. (16 , 1).  
c. (1 , 4).                        d. (4 , 1).



33. A girl stands watching water waves, she saw 4 waves passing in 2 seconds. The wavelength of each wave is 0.5 m, so

A) Wave frequency = .....

- a. 2 Hz.                          b. 4 Hz.

- c. 4 m/sec.                      d. 0.25 m/sec.

B) Wave velocity = .....

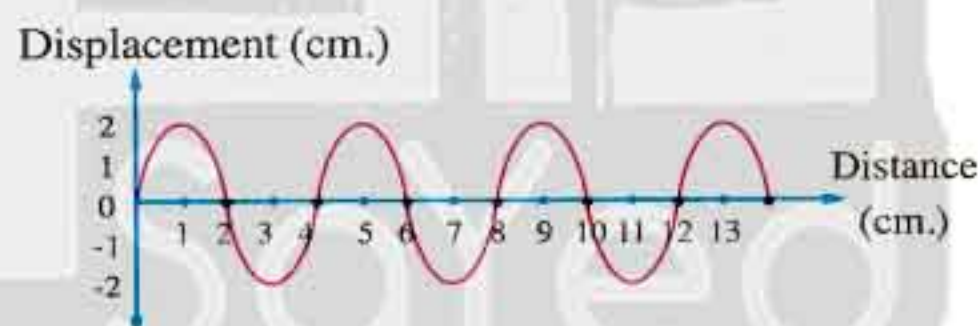
- a. 1 m/sec.                      b. 0.2 m/sec.

- c. 4 m/sec.                      d. 0.25 m/sec.

34. In the opposite figure :

A) The wavelength of the wave equals ..... cm.

- a. 2                                  b. 4  
c. 5                                  d. 6

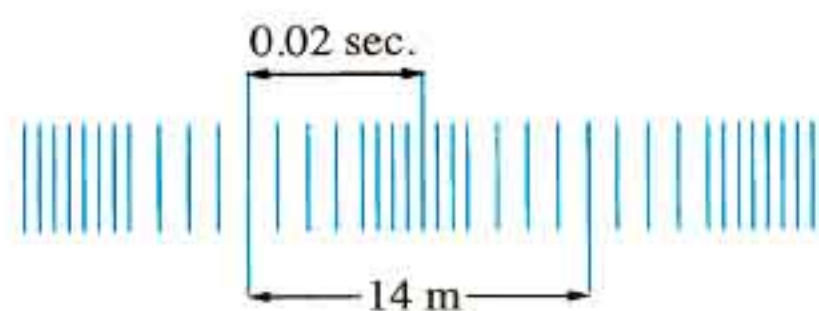


B) The amplitude of the wave equals ..... cm.

- a. 1                                  b. 3                                  c. 2                                  d. 4

35. The wavelength and velocity of the opposite longitudinal wave are .....

- a. (14 m , 350 m/sec.)  
b. (7 m , 700 m/sec.)  
c. (7 m , 0.14 m/sec.)  
d. (14 m , 0.28 m/sec.)



36. All the electromagnetic waves have the same ..... in vacuum.

- a. velocity                      b. amplitude                      c. frequency                      d. periodic time

37. 1 millimetre = .....

- a.  $1 \times 10^6$  nanometre.                      b.  $1 \times 10^3$  micrometre.  
c.  $1 \times 10^{-3}$  metre.                              d. all the previous answers.



## UNIT

## 1

## 2. Put (✓) or (x) :

1. Wave is a disturbance that causes the oscillation of medium particles. ( )
2. Sound waves transmit the sound energy to the source of sound in the direction of its propagation. ( )
3. Waves are classified according to the ability to propagate and transfer energy into mechanical waves and longitudinal waves. ( )
4. Water waves are mechanical waves because they propagate through vacuum. ( )
5. Light and sound waves are examples of electromagnetic waves. ( )
6. A transverse wave is formed of crests and troughs. ( )
7. Water and light waves are examples of transverse waves. ( )
8. Crest is the highest point of the particles of the medium in the transverse wave. ( )
9. Sound waves are transverse waves, which propagate through media in the form of compressions and rarefactions. ( )
10. The wavelength of a transverse wave is the distance between the two successive crests or troughs. ( )
11. 1 nanometer =  $1 \times 10^{-6}$  metre. ( )
12. Amplitude of a wave is the time taken for one wave. ( )
13. The distance covered by the wave in one second is called wave velocity. ( )
14. The measuring unit of wave velocity is m/sec., while that of wavelength is Hertz. ( )
15. The frequency of a wave is directly proportional to its wavelength when it propagates through the same medium. ( )
16. Wave velocity is constant in the same medium and differs from one medium to another. ( )
17. Sound velocity through liquids is more than that through gases. ( )
18. Wave velocity = Wave frequency  $\times$  Number of waves in one second ( )
19. Radio waves and light waves have the same frequencies in vacuum. ( )
20. The distance between the first crest and second crest is longer than distance between the second trough and third trough. ( )
21. 4 nanometre =  $400 \times 10^{-11}$  metre. ( )
22. Nonometre is bigger than micrometre. ( )
23. We can apply law of wave propagation for all wave types. ( )


## 3. Write the scientific term of each of the following :

1. A disturbance that propagates and transfers energy along the direction of propagation.
2. The motion produced as a result of the vibration of the particles of the medium at a certain moment in a definite direction.
3. The direction through which the wave propagates.
4. The waves, which need a medium to propagate.



5. • The waves, which do not need a medium to propagate.  
• A type of waves that can propagate through vacuum.
6. Waves, in which the particles of the medium vibrate perpendicular to the direction of propagation without transferring from their positions.
7. The highest point of the particles of the medium in the transverse wave.
8. The lowest point of the medium particles in the transverse wave.
9. Waves, in which the particles of the medium vibrate in the same propagation direction.
10. The area in the longitudinal wave, at which the medium particles are of the highest density and pressure.
11. The area in the longitudinal wave, at which the medium particles are away from each other.
12. A design is composed of a tub, where water moves in the form of circular waves for treating sprains and cramps.
13. The distance between two successive crests or troughs.
14. The distance between the centres of two successive compressions or two successive rarefactions.
15. The measuring unit of wavelength.
16. The maximum displacement of the medium particles away from their rest positions.
17. The distance covered by the wave in one second.
18. The measuring unit of wave velocity.
19. The number of waves produced from the source in one second.
20. The time required by the source to make one wave.
21. The relationship between wave velocity , frequency and wavelength in the wave motion.
22. The measuring unit of the frequency.



#### 4. Complete the following statements :

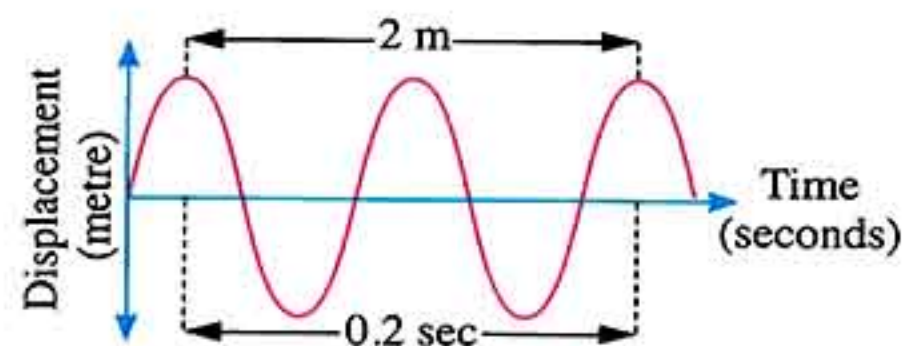
1. In wave motion, the waves transfer ..... from the vibrating source to the medium ..... in their propagation direction.
2. When the tuning fork oscillates , ..... is generated and travels in the form of sound waves.
3. The molecules of the medium ..... during the passing of waves in the direction of wave propagation without ..... from their rest positions.
4.  Waves are classified according to the ability to propagate and transfer energy into ..... and ..... waves.
5. Waves are classified according to the direction of vibration of medium particles relative to the direction of propagation into ..... and ..... waves.
6. The mechanical waves are classified into ..... and ..... waves.
7. .... waves do not need a medium to propagate through, such as ..... waves.
8. .... waves need a medium to propagate through, such as ..... and ..... waves.



## UNIT

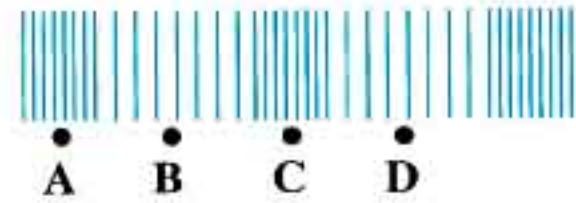
## 1

9.  Radio waves are considered as ..... waves that propagate through free space with a velocity of .....
10. Transverse wave consists of ..... and .....
11. In the ..... waves, the particles of the medium oscillate perpendicular to the wave propagation direction. While in the ..... waves, the particles of the medium oscillate along the wave propagation direction.
12. Trough is the ..... point of medium particles in the ..... wave.
13. The maximum point of the particles of a medium of a transverse wave is called ....., while the maximum displacement of the simple pendulum from its rest position is called .....
14. The longitudinal wave consists of ..... and .....
15. .... is the area in the longitudinal wave at which the medium particles are of the highest density and pressure.
16.  The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.
17. Jacuzzi is used to treat ..... and cramps by using hot water and ..... by using cold water.
18. The wavelength of the transverse wave is the distance between .....
19. The wavelength of the longitudinal wave is the distance between .....
20. The amplitude of the wave is the ..... displacement of the medium particles away from their .....
21. Wave velocity represents the velocity of the transfer of the ..... carried by the .....
22. The velocity of sound waves through air is ..... than its velocity through liquids, while its velocity through solids is ..... than that through liquids.
23. .... is the measuring unit of wavelength, while ..... is the measuring unit of wave velocity.
24. Wave frequency is the number of ..... produced from the source in one .....
25. Wave frequency =  $\frac{\text{.....}}{\text{Time in seconds}}$
26. A vibrating source makes 500 waves in 10 seconds, where the wavelength of the wave is 20 cm. so that :
  - a. Its frequency equals .....
  - b. Wave velocity equals .....
  - c. The periodic time of the wave equals .....
27. **From the opposite figure :**
  - a. Wavelength = ..... metre
  - b. Periodic time = ..... seconds
28. Wave velocity = .....  $\times$  .....
29. The frequency of the wave =  $\frac{\text{.....}}{\text{Periodic time}} = \frac{\text{Wave velocity}}{\text{.....}}$





30. a. The opposite figure represents ..... wave, its wavelength is the distance between ..... or .....  
 b. If the wave velocity is 340 m/s. and the distance between B , A = 0.85 m , the wave frequency = ..... Hz



### 5. Correct the following statements without changing the underlined parts :

1. The movement of the clock pendulum is an example of wave motion.
2. In wave motion, medium particles move from their places.
3. Waves are classified according to the direction of vibration of medium particles into mechanical and electromagnetic waves.
4. Mechanical waves are those waves that do not need a medium to propagate such as radio waves.
5. Light waves and sound waves are examples of electromagnetic waves.
6. Compression is a part of a wave, at which the medium particles are far apart from each other.
7. The transverse wave is a disturbance in which the particles of the medium vibrate along the direction of wave propagation.
8. Wave frequency is the number of amplitudes that are done by the source in a minute.
9. The velocity of sound waves through water = 340 m/s
10. Wavelength =  $\frac{\text{Wave velocity}}{\text{Periodic time}}$
11. A body of frequency 200 Hz makes one complete wave in 200 seconds.

### 6. Give reasons for each of the following :

1. Wave motion is considered as a periodic motion.
2. When a billiard ball strikes a similar second one at rest, the second ball moves while the first one stops.
3. Sound waves are mechanical waves, while radio waves are electromagnetic waves.
4. Water waves are transverse mechanical waves.
5. Sound waves are longitudinal mechanical waves.
6. The waves produced due to vibration of a string are transverse mechanical waves.
7. We see lightning before hearing thunder.
8. The explosions occurring on the Sun surface can't be heard on the Earth.
9. The flame of a candle vibrates forward and backward if we put the candle in front of a loudspeaker.
10. The frequency of the vibrating body decreases by the increase of its periodic time.



## UNIT



## 1

11. Wave frequency is inversely proportional to the wavelength of the wave when it propagates in the same medium.
12. The difference in the wave velocity when a wave transfers from a medium to another.
13. The velocity of light waves equals the velocity of radio waves, although the difference in their frequencies.

**7. Define each of the following :**

- |                                       |  |
|---------------------------------------|--|
| 1. The wave.                          | 2. Wave motion.                          |
| 3. Transverse wave.                   | 4. Crest.                                |
| 5. Trough.                            | 6. Longitudinal wave.                    |
| 7. Compression.                       | 8. Rarefaction.                          |
| 9. The wavelength of transverse wave. | 10. The wavelength of longitudinal wave. |
| 11. The amplitude of the wave.        | 12. Wave velocity.                       |
| 13. Wave frequency.                   | 14. Line of wave propagation.            |
| 15. Mechanical waves.                 | 16. Electromagnetic waves.               |

**8. What is meant by ... ?**

1.  Wavelength of a sound wave is 30 cm.
2. The distance between two successive crests in water waves is 10 cm.
3. Amplitude of a vibrating source is 5 cm.
4.  The distance that is covered by a visible light waves in two seconds is  $6 \times 10^8$  metres.
5. Velocity of light is 300 000 km/sec.
6. Velocity of sound = 340 m/sec.
7. Frequency of a longitudinal wave is 600 waves/second.
8. Law of wave propagation.

**9. What is the relationship between ... ?**

1. Wave frequency and number of waves produced by a source in a certain time.
2. Wave frequency and wavelength.
3. Wave velocity and wavelength.
4. Wave velocity and distance covered by wave.

**10. What does each of the following relationship indicate ?**



- |  |  |
|--|--|
| 1. $\frac{\text{Distance covered by the wave}}{\text{Time (seconds)}}$ | 2. $\frac{\text{Number of waves}}{\text{Time (seconds)}}$                |
| 3. $1/\text{Frequency}$  | 4. $\text{Wave frequency} \times \text{Wavelength}$                      |
| 5. $\frac{\text{Wave velocity}}{\text{Frequency}}$                     | 6. $\frac{\text{Number of waves} \times \text{Wavelength}}{\text{Time}}$ |

**11. What happens when ... ?**



1. You throw a stone in water.
2. Propagation of a wave in a medium as pulses of compressions and rarefactions (Concerning the particles of the medium).



## Lesson Two

3. You move the free end of a horizontal spiral spring fixed from the other end perpendicular to its axis.
4.  The particles of a medium vibrate in a direction normal (perpendicular to) the direction of wave propagation.
5. The sound wave travels from air to water (concerning its velocity).
6.  The frequency of a wave is doubled (concerning the wavelength) when the wave velocity is constant.
7. The frequency and velocity of wave propagation decreases to quarter (concerning the wavelength).


**12. Compare between :**

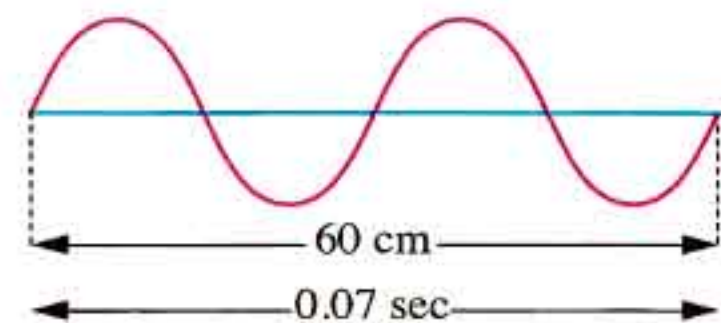
1. Mechanical waves and electromagnetic waves.
2.  Transverse waves and longitudinal waves.
3. Wave velocity and wavelength (concerning the measuring unit).
4. Frequency and amplitude of the wave (concerning the definition).
5.  Oscillatory (vibrational) motion and wave motion.

**13. Show by activity :**

1. The role of the wave in transferring energy.
2. • The concept of wave motion.  
• The particles of the medium don't move in the waves propagation direction.
3. The nature of transverse waves.
4. The nature of longitudinal waves.

**14. Problems :**

1.  Sound waves of frequency 200 Hertz and wavelength 1.7 metre. **Calculate :**
  - a. The velocity of sound waves propagation in air.
  - b. The wavelength of these waves of frequency 200 Hz when they propagate in water with velocity 1500 m/s.
2. The velocity of the propagation of a sound wave through wood is 1800 m/sec. Find the frequency of the sound source if the wavelength of the produced wave is 6 metres.
3. If the frequency of a sound wave in air is 660 Hertz and the distance between the centres of the second and the seventh compressions is 2.5 metres, calculate the velocity of the sound through air.
4. The opposite figure shows a transverse wave.  
From the given information, find the velocity of propagation of such wave in (metre/second).





## UNIT

## 1

5. A tuning fork knocked with a frequency = 260 Hz.

A person heard it when he/she was located in a distance = 17 metre faraway it.

If the velocity of sound in air = 340 m/s. Find the number of produced waves from this fork till it reaches the ear of the person.

6. If you know that water waves propagate with a velocity = 8 m/sec. and they make 20 waves in a time = 5 sec. Calculate the distance between the first crest and the third crest of these waves


### 15. Variant questions :

(1) Mention the uses of :

1. Jacuzzi.

2. Radio waves.

(2) Arrange the media (water - iron - oxygen) ascendingly according to the ability of transferring sound waves.

(3)  Cross the odd word out, then state the relation among the remaining words :

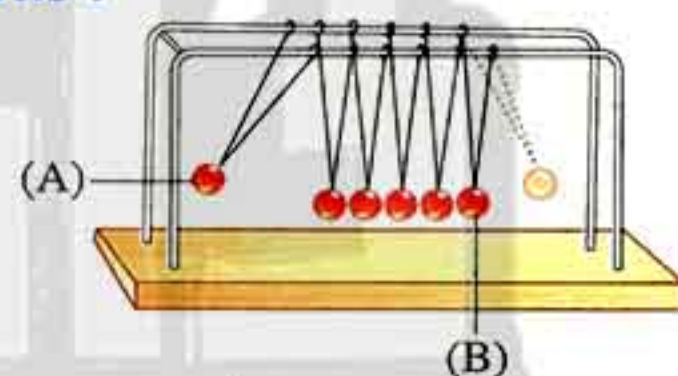
1. Sound wave - Light wave - Radio wave - Infrared wave.

2. Pendulum's motion - Spring motion - Rotary bee motion - Stretched string motion.

### 16. Study the following figures, then answer the questions :

(1) From the opposite figure :

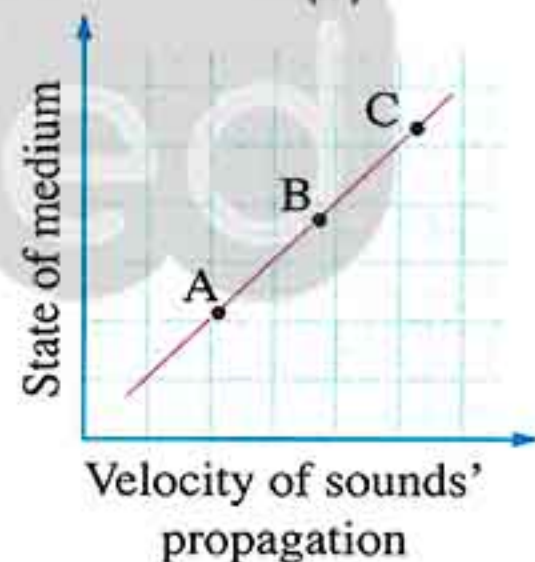
What is your explanation for the movement of the ball (B) when the ball (A) collides the other balls although ball (A) does not touch the ball (B) ?



(2) Complete the missing parts in the table by observing the graph.

(the states of the media are gases, solids and liquids)

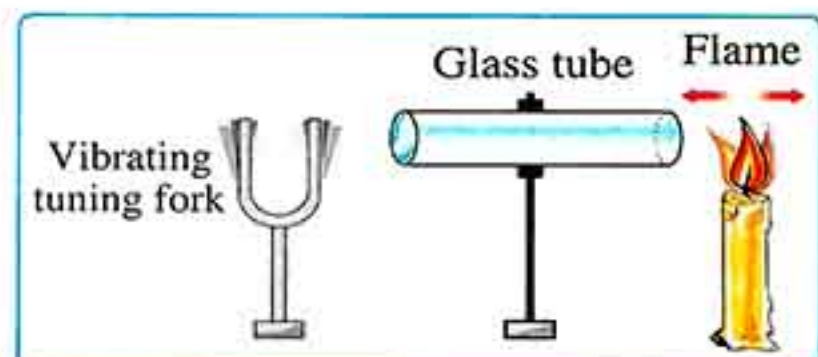
| Point           | A     | B     | C     |
|-----------------|-------|-------|-------|
| State of medium | ..... | ..... | ..... |



(3) Fix a glass tube horizontally then put a lighted candle at one end. Hit a tuning fork and put it at the other end of the tube.

1. What do you observe ?

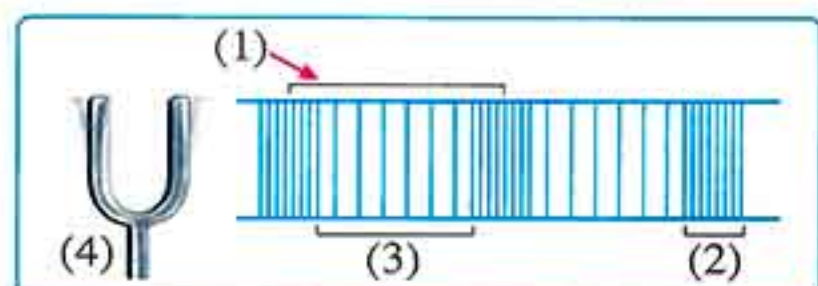
2. What do you conclude ?



(4) Examine the opposite figure, then answer the following questions :

1. What does this figure show ?

2. Label the figure.

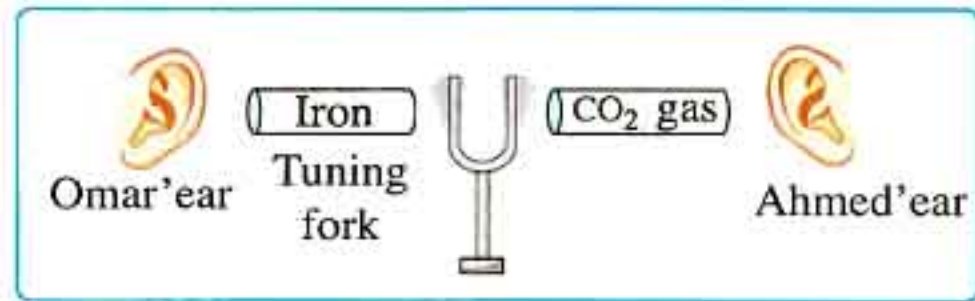




## Lesson Two

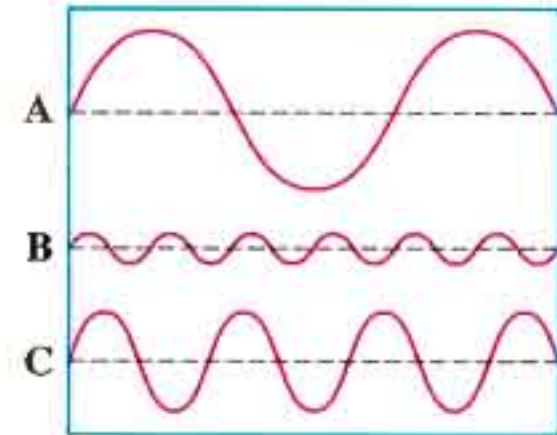
## (5) From the opposite figure :

1. What is the type of waves produced from the tuning fork ?
2. To any of, Ahmed or Omar, the sound will reach faster ? (Give a reason for your answer).



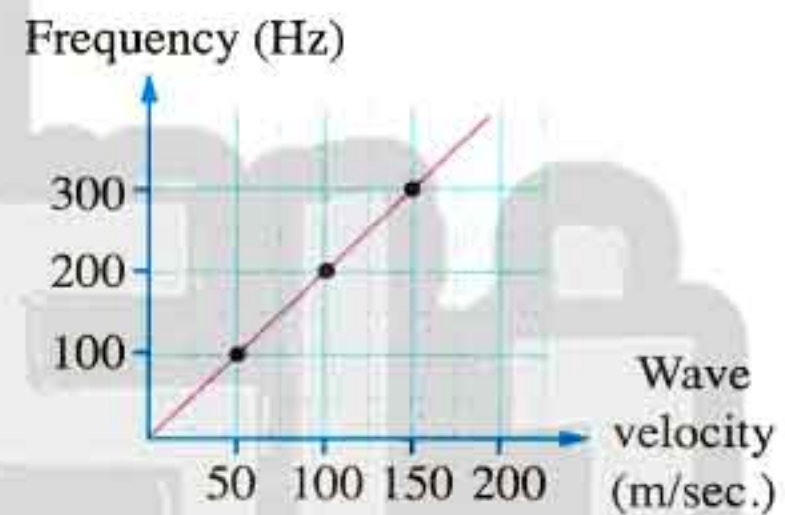
## (6) The opposite figure represents three transverse waves (A , B and C) which one has :

1. The largest frequency.
2. The smallest amplitude.
3. The longest wavelength.

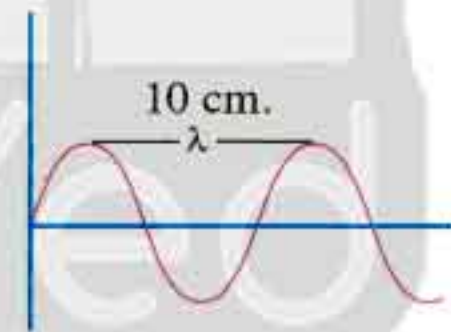


## (7) Look at this graph, then conclude the following :

1. The relation between frequency and wave velocity.
2. The wave velocity when frequency is 200 Hz.
3. From two different points, calculate the wavelength of such a wave.

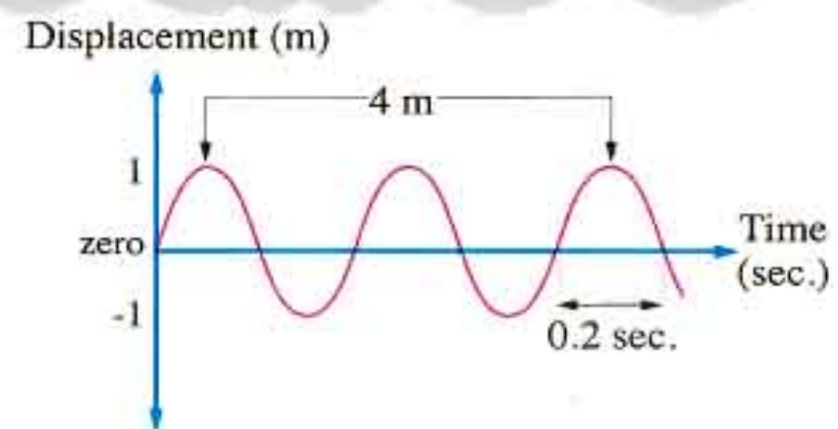


## (8) What is the kind of this wave and what is its velocity of propagation when it produces 600 vibrations in a minute?



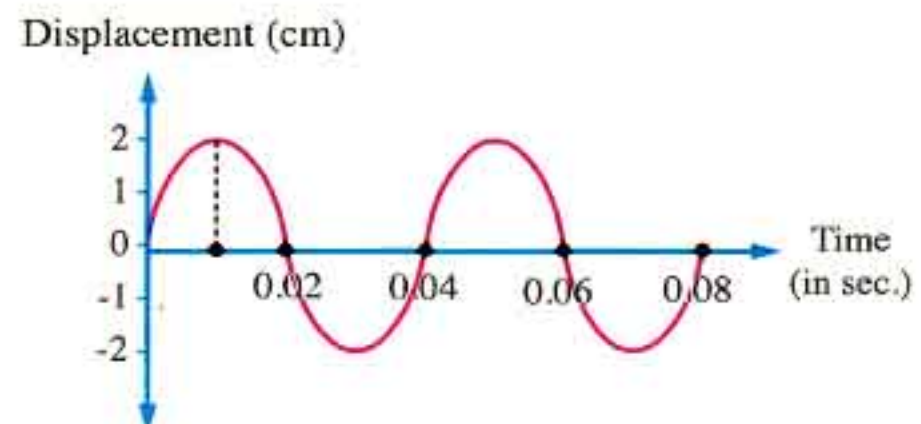
## (9) From the opposite figure, find :

1. Wavelength.
2. Frequency.
3. Amplitude.
4. Wave velocity.



## (10) The opposite figure shows the relation between the displacement and the time in a transverse wave that takes place in water with velocity of 20 metres/second. From the labelled figure, find the value of :

1. Amplitude.
2. Frequency.
3. Wavelength.



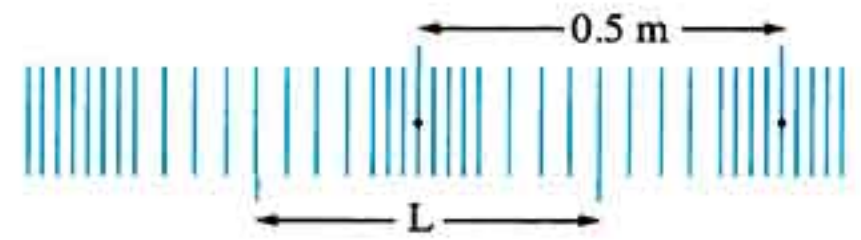


## UNIT

## 1

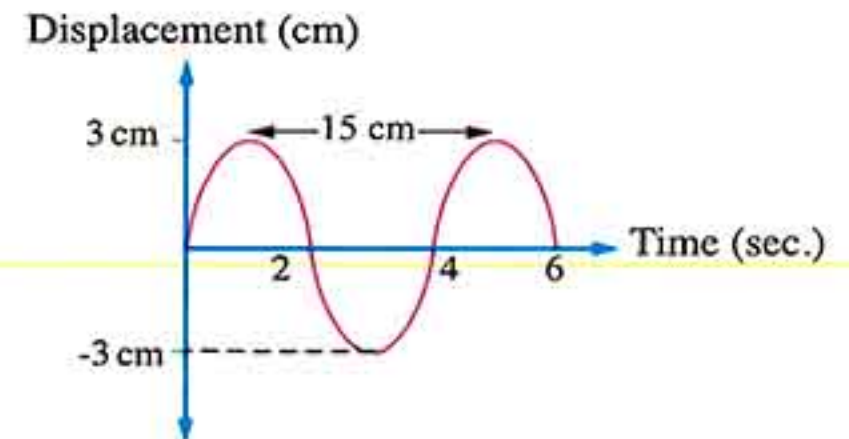
(11) A sound source of frequency 660 Hz produces the given wave. Calculate :

1. The distance (L) and what does it indicate ?
2. The velocity of the sound wave.



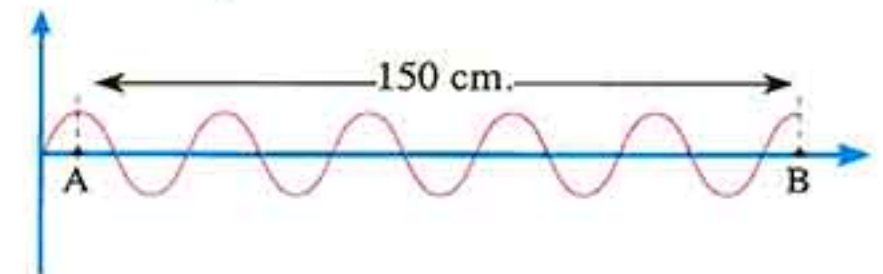
(12) From the opposite figure :

1. Define the amplitude and find its value from the figure.
2. Define the wavelength in this case and find its value.



(13) The opposite figure represents a wave :

1. What is the type of this wave ?
2. Calculate its wavelength.
3. If the time of propagation of such wave between A and B is 10 seconds, calculate its frequency and periodic time.



(14) The opposite figure represents the relation between the displacement in metres and time in seconds from the drawing, answer the following questions :

1. Amplitude = .....

- |          |          |
|----------|----------|
| a. 2 cm. | b. 3 cm. |
| c. 4 cm. | d. 8 cm. |

2. Periodic time = .....

- |                   |            |
|-------------------|------------|
| a. 1/8 cycle/sec. | b. 0.25 Hz |
| c. 4 sec.         | d. 8 sec.  |

3. Frequency = .....

- |           |            |           |          |
|-----------|------------|-----------|----------|
| a. 1/8 Hz | b. 0.25 Hz | c. 4 sec. | d. 8 cm. |
|-----------|------------|-----------|----------|

4. Wavelength = .....

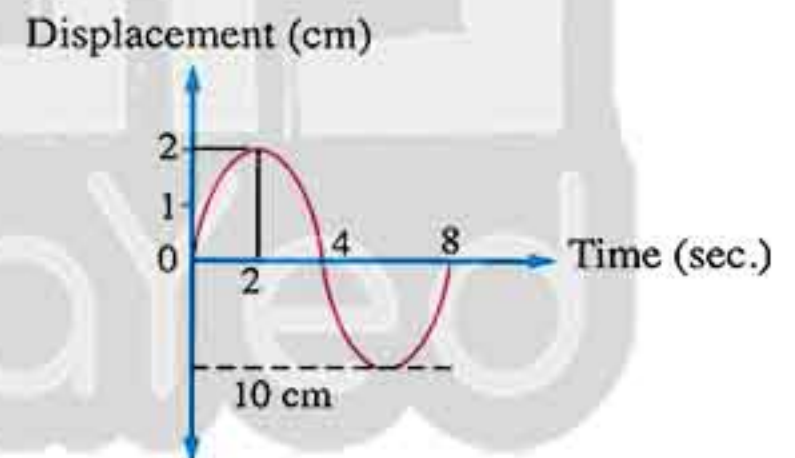
- |           |            |          |           |
|-----------|------------|----------|-----------|
| a. 1/8 Hz | b. 0.25 Hz | c. 4 cm. | d. 10 cm. |
|-----------|------------|----------|-----------|

5. Wavelength in meters = .....

- |                   |            |         |           |
|-------------------|------------|---------|-----------|
| a. 1/8 cycle/sec. | b. 0.25 Hz | c. 1 m. | d. 0.1 m. |
|-------------------|------------|---------|-----------|

6. Wave velocity = .....

- |             |               |             |                  |
|-------------|---------------|-------------|------------------|
| a. 1 m/sec. | b. 0.2 m/sec. | c. 4 m/sec. | d. 0.0125 m/sec. |
|-------------|---------------|-------------|------------------|





# Timss Questions



**1. Choose : What do you deduce about sound velocity in different media ? .....**

- a. Velocity of sound through solids is equal to that in liquids.
- b. Velocity of sound through gases is faster than in liquids.
- c. Velocity of sound through liquids is faster than in solids.
- d. Velocity of sound through solids is faster than in gases.

**2. Write the scientific term of the following :**

The ratio between wavelength of a wave and its periodic time.

**3. Calculate frequency of a water wave if the time between two successive crests is 0.2 second.**

**4. Calculate velocity of a transverse wave in which every 11 crests pass by a certain point in one second. Knowing that the wavelength of this wave is 30 cm.**

**5. An oscillating source produces a pulse every  $\frac{1}{4}$  second if the wavelength of the produced waves is 2 cm. Calculate :**

- a. Frequency of the oscillating source.
- b. Wave velocity of the produced waves.

**6. Two waves of the same type spread in one medium if their frequencies are 512, 256 respectively. Find the ratio between their wavelengths.**



## UNIT

## 2

## Sound and Light

## ▶ Lessons of the unit :

1. Properties of Sound Waves.
2. Wave Nature of Light.
3. Reflection and Refraction of Light.



## ▶ Unit Objectives :

By the end of this unit, students will be able to :

- Identify the wave nature of sound.
- Conclude some properties of sound like; sound pitch, sound intensity and sound quality.
- Use materials and tools to illustrate the factors affecting the pitch and intensity of sound.
- Identify the wave nature of light.
- Conclude the laws of reflection and refraction of light.
- Describe some natural phenomena related to light reflection and refraction.





- Appreciate the importance of light to human life and society.
- Like to work with others in small co-operative groups.
- Appreciate the value of co-operative and team work.
- Recognize the interaction between science and technology and the society.
- Become objective, honest and highly precise when carrying out scientific experiments.



## Properties of Sound Waves



## How

is sound produced ?

Sound is produced due to the vibration of bodies and it stops when the vibrating bodies stop their vibration.

## Sound :

It is an external factor (or stimulus) that affects the ear causing the sense of hearing.

## The nature of sound waves

▶ **Sound waves are mechanical longitudinal waves.** GR.

- They are **mechanical waves** because they need a medium (as air) to propagate through.
- They are **longitudinal waves** because the medium particles vibrate in the same direction of wave propagation forming compressions and rarefactions.

▶ **Sound waves propagate through media as spheres of compressions and rarefactions, whose centre is the source of sound.**



GR.

**We hear sound from all directions that surround the sound source.**

Because the sound travels through air as spheres of compressions and rarefactions, whose centre is the source of sound.



## ? What is meant by ?

The wavelength of a sound wave is 1.5 m ?

- ➔ This means that the distance between the centres of two successive compressions or two successive rarefactions is 1.5 m.

## Sound velocity

### Sound velocity :

It is the distance, which is covered by the sound waves in one second.

Sound waves propagate through different media with different velocities.

### Notes

- Sound travels through air at a velocity 340 m/sec. (It may exceed or become less than this value)
- Sound velocity through solids is larger than that through liquids.
- Sound velocity through liquids is larger than that through gases.
- **i.e. Sound velocity through : Solids > Liquids > Gases**

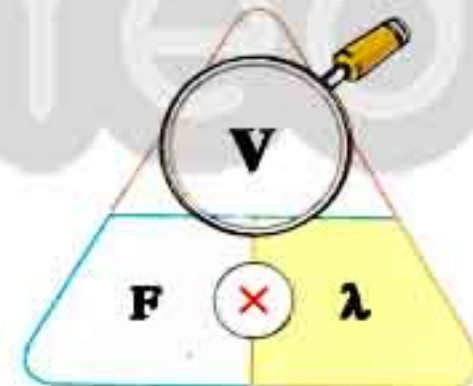
### Enrichment information

The velocity of sound through air depends on :

- The temperature of air.
- The air pressure.
- The humidity in air.

- ➔ Sound velocity can be calculated by using waves propagation law :

$$\text{Sound waves velocity (V)} \quad (\text{metre/second}) \quad = \quad \text{Wave frequency (F)} \quad (\text{Hertz}) \times \text{Wavelength } (\lambda) \quad (\text{metre})$$



## Problems

- 1 Sound waves are produced from a vibrating tuning fork of frequency 512 cycles/sec. If the wavelength of these waves is 60 cm., calculate its velocity through air.

### Solution

$$\begin{aligned} \text{Sound wave velocity (V)} &= \text{Wave frequency (F)} \times \text{Wavelength } (\lambda) \\ &= 512 \times \frac{60}{100} = 307.2 \text{ m/sec.} \end{aligned}$$



UNIT  
2

- 2 Calculate the wavelength of a sound wave propagating through sea water with velocity 1500 m/sec. knowing that its frequency is 10 kilohertz

**Solution**

$$\text{Frequency (F)} = 10 \times 10^3 = 10000 \text{ Hz}$$

$$\therefore \text{Sound wave velocity (V)} = \text{Wave frequency (F)} \times \text{Wavelength (\lambda)}$$

$$\therefore \lambda = \frac{V}{F} = \frac{1500}{10000} = 0.15 \text{ m. (15 cm.)}$$

**Audible sounds**

Sounds heard by the human ears are classified into two types :

1. Musical tones.

2. Noises.

1

**Musical tones**

- They are tones of uniform frequency and comfortable to be heard.
- **Examples :** Violin, piano and reed pipe.



Violin



Piano



Reed pipe

2

**Noises**

- It is sound of non-uniform frequency and uncomfortable to be heard.
- **Examples :** Drill, loudspeakers and horns of cars.



Drill



Loudspeakers



Horns of cars

**Real Life application : Ear plugs**

Ear plugs made of silicon are sold in pharmacies. They take the shape of the external ear canal, where these plugs are used to avoid the hazards of noise in loud places.





## Properties of sound waves

➔ The human ears can differentiate between the sounds that reach it through three different properties (characteristics), which are :

1. Sound pitch.
2. Sound intensity.
3. Sound quality (type).

1

### Sound pitch :

#### Sound pitch:

It is the property, by which the ears can distinguish (differentiate) between harsh and sharp voices.

- Sound is described as high pitched or low pitched sound, where :
  - High pitched sound is sharp (soft).
  - Low pitched sound is harsh (rough).

#### So, it is said that :

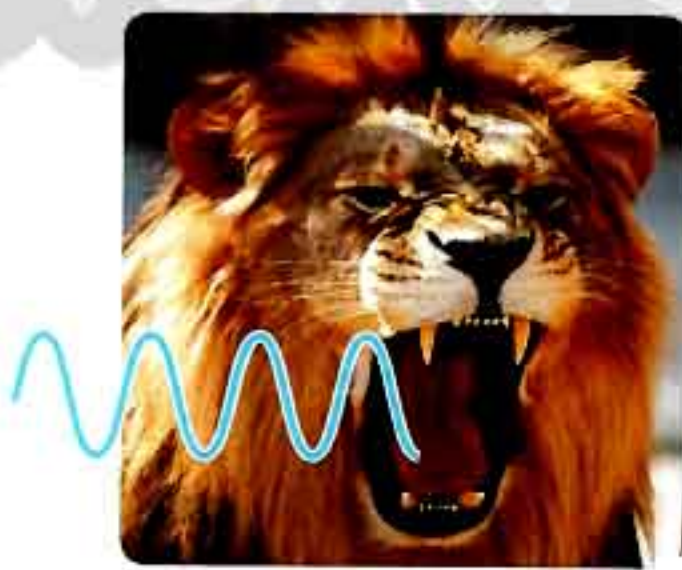
- The voice of woman is high pitched as it is sharp.
- The voice of man is low pitched as it is harsh.
- Similarly, the voice of the lion is harsher than that of sparrow.



High pitched sound



Low pitched sound



Low pitched sound



High pitched sound

NB

As the sound pitch (level) gets higher, the sharpness of voice increases.



UNIT  
2

## ACTIVITY

1

To illustrate the concept of sound pitch and its relation with sound frequency :



## Materials and tools :

- Big-sized book.
- Rubber string (or band).
- Two pencils.

| Steps  | Figure | Observations   |
|--|--------|--|
| <ol style="list-style-type: none"> <li>1. Tie the rubber string around the book and put the two pencils below it (as shown in the figure).</li> <li>2. Press on the string by the forefinger of the left hand at 10 cm. from one of the two pencils, then vibrate this segmented part of the string by the forefinger of the right hand.</li> <li>3. Repeat the previous step by increasing the length of the vibrating segmented part of the string several times.</li> </ol> |        | <ul style="list-style-type: none"> <li>• The sound pitch changes as the length of the vibrating segment changes, where :               <ul style="list-style-type: none"> <li>- The sound becomes more sharper as the length of the string decreases.</li> <li>- The sound becomes more harsher as the length of the string increases.</li> </ul> </li> <li>• The number of vibrations produced in one second (frequency) decreases by increasing the length of the string.</li> </ul> |



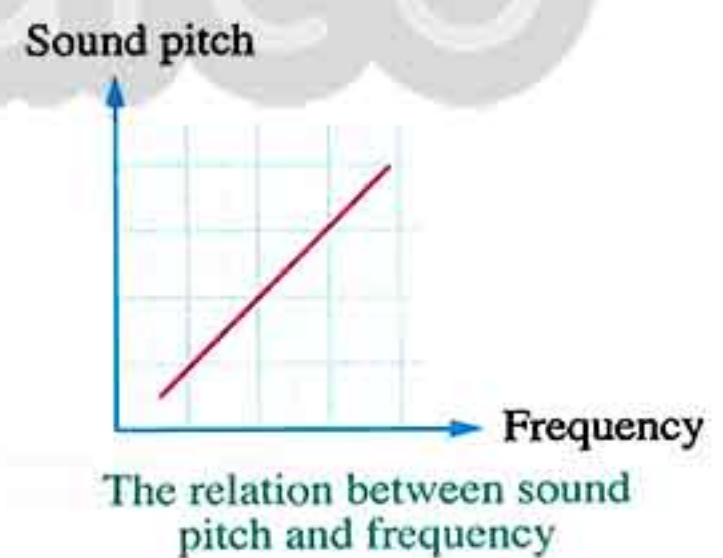
## Conclusions :

- The sound pitch is a property of sound by which the ear can distinguish between harsh and sharp voices.
- The sound pitch depends on the frequency of the sound source.
- The sound pitch increases by increasing the frequency and vice versa.

Sound pitch  $\propto$  Frequency

Therefore :

The sharp tones have high frequency, while the harsh tones have low frequency.



So :

By increasing the length of the string (vibrating segmented part)



The frequency decreases



The sound becomes low pitched (harsh).



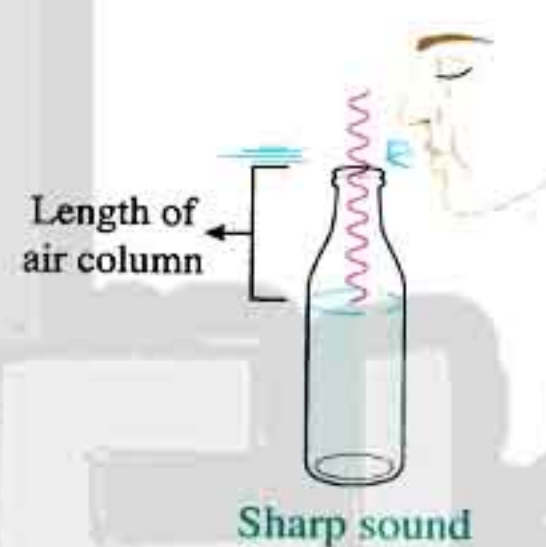
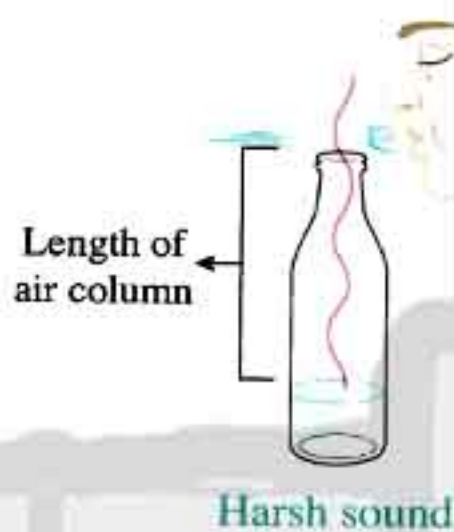
## Lesson One

## Producing sound from vibration of air column :

- We have explained how sound is produced from vibration of strings similar, sound can be produced from vibration of air columns.
- In case of vibration of air columns, the sound pitch depends on the length of the vibrating air column,

As the length of the vibrating air column **increases**, the sound frequency **decreases**, so the harshness of sound **increases**.

As the length of the vibrating column **decreases**, the sound frequency **increases**, so the sharpness of sound **increases**.



NB

Frequency increases by decreasing the length of air column and vice versa.

So :

By increasing the length of the vibrating air column



The frequency decreases

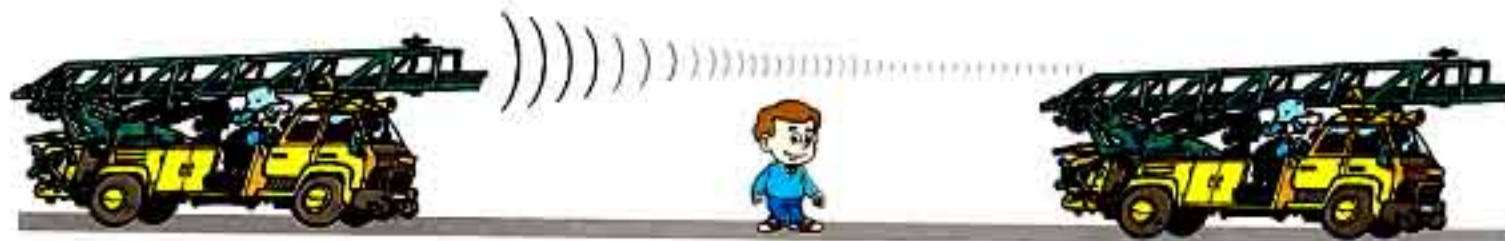


The sound becomes low pitched (harsh).

### ► Enrichment information

**Doppler's effect** : It is the apparent change in the frequency of a sound wave for an observer moving relative to the source of sound wave.

It is commonly heard when a vehicle (carfire) sounding a siren approaches you gradually, the sound pitch increases and decreases suddenly as it moves away.



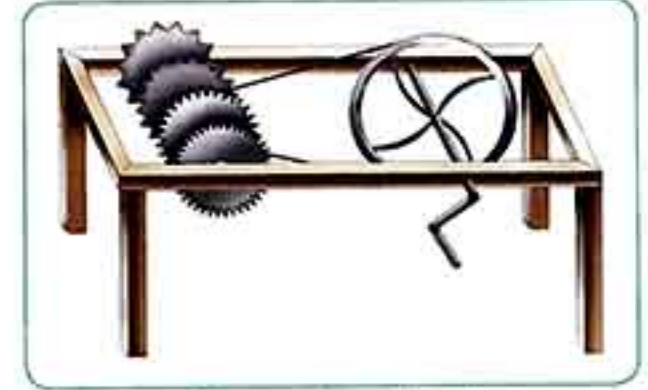


UNIT  
2

## Determining the pitch of a tone by using Savart's wheel :



Savart's wheel is used to determine the pitch (frequency) of an unknown tone.

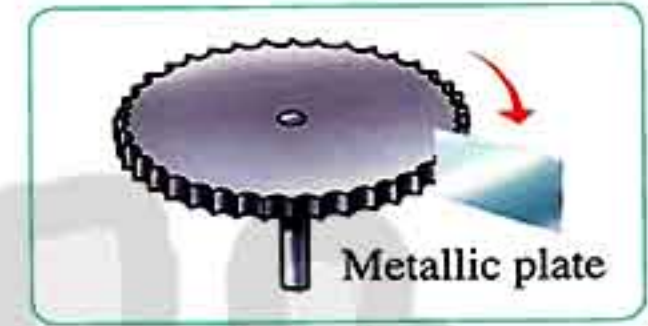


Savart's wheel

### Steps for determining the pitch of a tone using Savart's wheel :

1. Listen to the tone you want to determine its pitch till your ears get used to it.

2. Rotate Savart's wheel at the same time one of the gears teeth contacts a flexible metallic sheet (as shown in the opposite fig.).



Toothed gear

3. Increase the speed of rotation till you hear a sound similar to that of the unknown tone.

4. Calculate the number of cycles (turns) (d) taking place in a specific duration and by knowing the number of gear teeth (n), you can determine the frequency of the tone, as follows :

$$\therefore \text{Sound frequency (F)} = \frac{\text{Number of waves produced}}{\text{Time in seconds (t)}}$$

- From the figure : Each gear consists of a number of teeth, each tooth produces a wave when it touches the metallic plate.
- So, number of waves produced = Number of cycles (turns) (d) × Number of gear teeth (n)

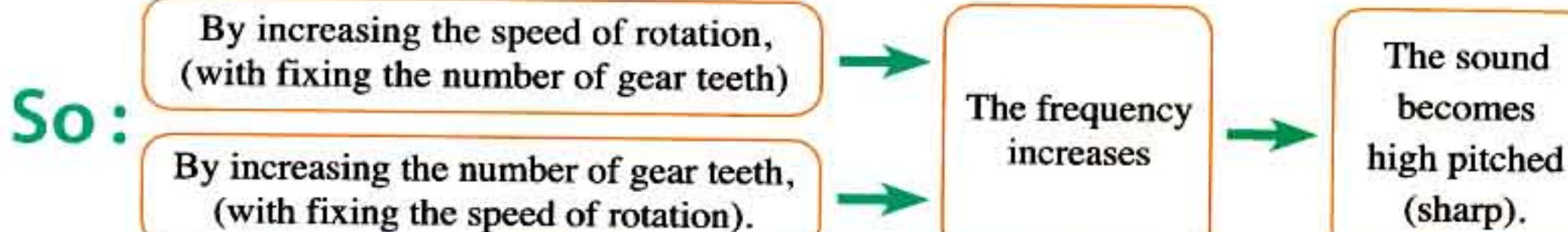
$$\therefore \text{Sound frequency (F)} = \frac{\text{Number of cycles (turns) (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

## Note

$$\text{Speed of rotation} = \frac{\text{Number of rotations (turns)}}{\text{Time in seconds (t)}}$$



## Lesson One



## Problems

- 1** Calculate the frequency of a musical tone similar to the frequency of a produced tone using Savart's wheel rotated with a velocity of 960 cycles in two minutes, given that the number of teeth of the gear is 30 teeth.

### Solution

$$\text{Time (t)} = 2 \times 60 = 120 \text{ seconds}$$

$$\text{Frequency (F)} = \frac{\text{No. of cycles (d)} \times \text{No. of gear teeth (n)}}{\text{Time in seconds (t)}} = \frac{960 \times 30}{120} = 240 \text{ Hz}$$

- 2** If the frequency of the sound produced by touching a metallic plate with a gear in Savart's wheel is 100 Hz. Calculate the number of the gear teeth, if the wheel rotates with speed 120 cycles/minute.

### Solution

$$\text{Frequency (F)} = \frac{\text{No. of gear teeth (n)} \times \text{No. of rotations (d)}}{\text{Time in seconds (t)}}$$

$$100 = \frac{\text{No. of gear teeth (n)} \times 120}{1 \times 60}$$

$$\text{No. of gear teeth (n)} = 100 \times \frac{60}{120} = 50 \text{ teeth}$$

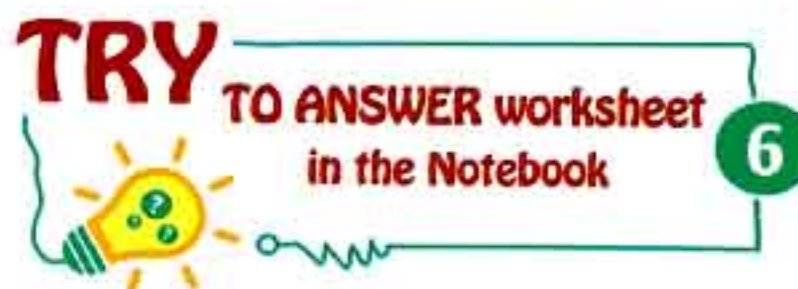
- 3** Calculate the time in minutes taken by Savart's wheel to make 600 cycles, if the frequency of the sound produced by touching a metallic plate with a gear of 60 teeth is 300 Hz.

### Solution

$$\text{Frequency (F)} = \frac{\text{No. of gear teeth (n)} \times \text{No. of rotations (d)}}{\text{Time in seconds (t)}}$$

$$300 = \frac{60 \times 600}{t}$$

$$\text{Time (t)} = \frac{36000}{300} = 120 \text{ seconds} = 2 \text{ minutes}$$





UNIT  
2

## 2

## Sound intensity (I) :

## Sound intensity:

It is the property, by which the ears can distinguish (differentiate) between sounds either strong or weak sound.

## Examples :

- A drum produces a strong (high) sound when it is beaten strongly and it produces weak (low) sound when it is beaten softly.
- Shouting is stronger than whispering (The level of sound intensity changes from one person to another).
- A cannon makes a stronger sound than that of a rifle.



The intensity of sound at a certain point is measured by the quantity of sound energy falling perpendicularly in one second on a unit area at that point.

If the sound energy is high, it gives a strong sound, but if it is low, it gives a weak sound.

## Notes

- The measuring unit of "sound intensity" is " $\text{watt/m}^2$ ".
- The measuring unit of "noise intensity" is "Decibel".

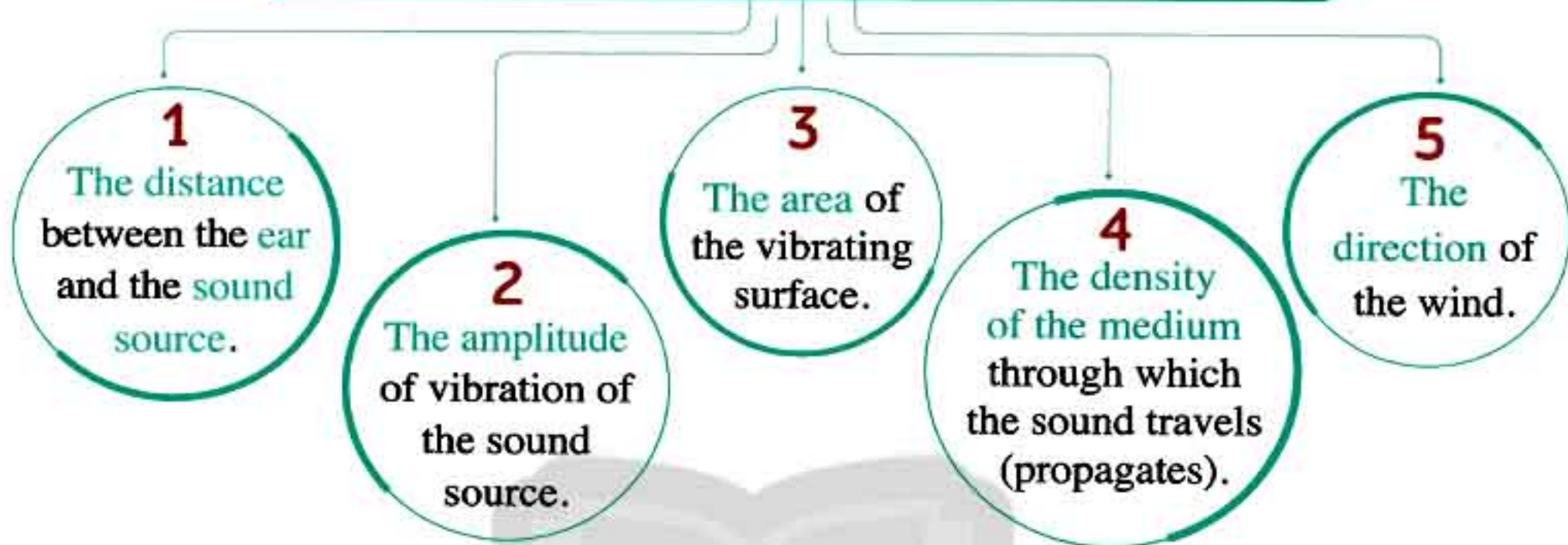
## ► Enrichment information

The following table shows that : As sound intensity increases, noise intensity increases.

| Sound source  | Sound intensity ( $\text{watt/m}^2$ ) | Noise intensity (decibel) |
|---|---------------------------------------|---------------------------|
| - Quiet sounds like whispering and rustling of trees. | $1 \times 10^{-12}$                   | zero                      |
| - Loud sounds like the sound of a motorbike.          | $1 \times 10^{-6}$                    | 60                        |
| - Deafening sounds like that of jet planes.           | $1 \times 10^3$                       | 150                       |



## Factors affecting the sound intensity



Now, we are going to study each of these factors individually :

### 1 The distance between the ears and the sound source

If you stand in front of your classmate, who produces a sound, then you move away from him gradually.



You notice that, the intensity of sound becomes fainter gradually as you move farther away from the sound source.

**This is because :**

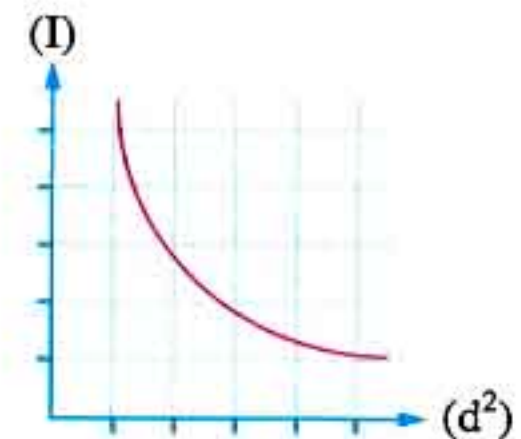
The intensity of sound ( $I$ ) at a point is inversely proportional to the square of the distance ( $d^2$ ) between that point and the sound source and this is known as "The inverse square law of sound".

### The inverse square law of sound:

The intensity of sound at a point is inversely proportional with the square of the distance between that point and the sound source.

$$\text{Sound intensity} \propto \frac{1}{\text{Square of the distance}} \quad \text{i.e. } I \propto \frac{1}{d^2}$$

This relation can be represented by the opposite graph.





UNIT  
2

## What happens when ?

The distance between the sound source and ears increases twice ?

→ The intensity of sound decreases to quarter.

The distance between the sound source and ear decreases to half ?

→ The intensity of the sound increases to four times its value.

GR.

- The intensity of sound increases four times when the distance between the sound source and the ear decreases to its half value.
- It is preferred to sit in the first rows more than in the back rows in lecture, classes.  
Because sound intensity is inversely proportional to the square of the distance between the ear and the sound source.

2

## The amplitude of vibration of the sound source



## ACTIVITY 2

To identify the effect of the amplitude of the sound source on the sound intensity :

| Steps  | Figure | Observation                                      |
|--|--------|--|
| 1. Fix one end of a ruler on the edge of a table by your right hand. |        | The intensity of sound decreases as time passes. |
| 2. Pull the other end of the ruler downwards, then leave it free.    |        |  |
| 3. Notice the sound produced by the vibration of the ruler.          |        |  |



## Explanation :

The amplitude of the ruler decreases gradually as time passes.

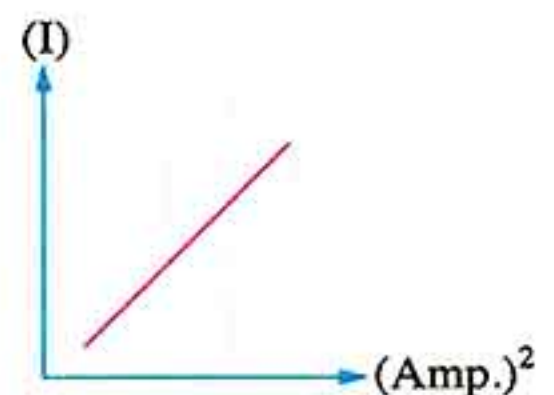


## Conclusions :

- Sound intensity decreases gradually by decreasing the amplitude of the vibration.
- Sound intensity is directly proportional to the square of the amplitude of the vibration of the sound source.

Sound intensity  $\propto$  Square of the amplitude

- This relation can be represented by the opposite graph.  
i.e. When the amplitude increases 2 times, the intensity of sound increases 4 times.

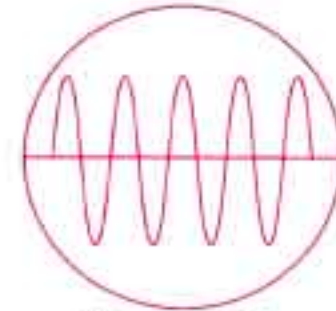




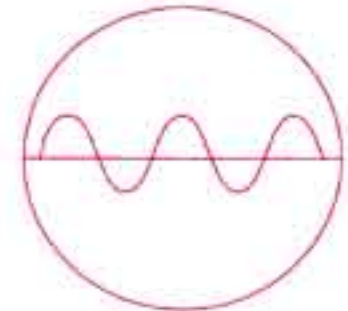
## Lesson One

**Exercise** Answer the following question :

Compare between the two given waves, concerning the pitch and intensity of sound.



Wave (A)



Wave (B)

**Answer**

- **Sound pitch** : Wave (A) has higher pitch (sharper) than wave (B).  
[Because the frequency of wave (A) is more than that of wave (B)].
- **Sound intensity** : Wave (A) has more intensity (stronger) than wave (B).  
[Because the amplitude of wave (A) is larger than that of wave (B)].

3

**The area of the vibrating surface****ACTIVITY**

3

To identify the effect of the area of the vibrating surface on the sound intensity :

| Steps   | Figure   | Observation  |
|---|--|--|
| 1. Hold your mobile, which is adjusted to the vibrating mode in your hand, then ring on it from another mobile. | <p>(Resonance box)<br/>Hollow empty box open from one side</p> | The sound produced from the phone which is placed on the resonance box, is stronger than that produced from the phone which is held. |
| 2. Put the phone on an empty box, which is opened at one of its sides to work as a resonance box.               |  |  |
| 3. Compare between the intensity of sound that is produced in each case.  |  |  |

**Explanation :**

The resonance box increases the vibrating surface area.

**Conclusion :**

Sound intensity increases when the source of sound touches a resonance body (box) due to the increase of the surface area of the vibrating body.



UNIT  
2

By increasing the surface  
area of the resonance box

The sound becomes  
more intense.

**Note**

We notice in the stringed musical instruments such as the guitar and the violin that the strings are fixed above an empty wooden box (resonance box) to increase the sound intensity.



Violin

**GR.**

**Sound intensity increases when the sound source touches a resonance box.**  
Due to the increase in the surface area of the vibrating body.

4

**The medium density****ACTIVITY 4**

To identify the effect of the medium density on the sound intensity :

**Materials and tools :**

- Air vacuum pump.
- Glass jar.
- Sound source (alarm clock).

| ⊙ Steps   | ⊙ Figure | ⊙ Observations   |
|---|----------|--|
| 1. Ring the alarm clock, then put it on the air vacuum pump and cover it by the glass jar.                |          | 1. The sound is heard clearly.   |
| 2. Evacuate (pump out) the air inside the jar gradually (by drawing the arm of the vacuum pump outwards). |          | 2. The sound intensity decreases gradually until it stops as the air is pumped out of the jar. |

**Explanation :**

The air density decreases as you pull the air vacuum pump outwards, so the sound intensity decreases.

**Conclusions :**

- Sound intensity decreases by decreasing the density of the medium and vice versa.
- Sound intensity is directly proportional to the density of the medium in which sound travels.



## Lesson One

By increasing the density of the medium in which sound travels

The sound becomes more intense.

GR.

**Sound intensity in case of the presence of carbon dioxide gas as a medium is higher than that in case of air.**

Because the density of carbon dioxide gas is more than that of air since the intensity of sound is directly proportional to the density of the medium.

**Example :**

- In which one of the two opposite figures, the heard voice is more intense ? Give a reason.

**Answer :**

- In the figure number (1) the heard voice is more intense, because the density of  $\text{CO}_2$  gas is higher than that of  $\text{H}_2$  gas.
- And so the sound intensity increases by increasing the density of the medium in which it transmitted through.

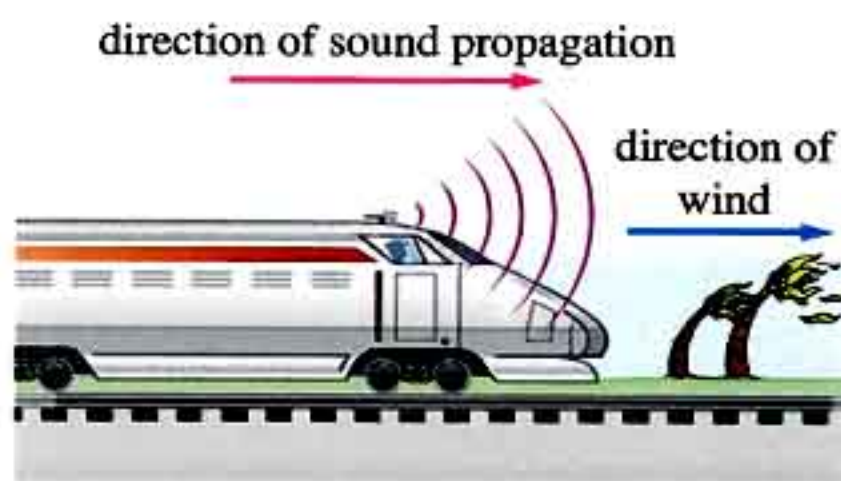
**► Enrichment information**

Sound intensity of a fired shot on the top of a mountain is less than that at its foot (bottom) because the density of air at high regions is less than that at the ground.

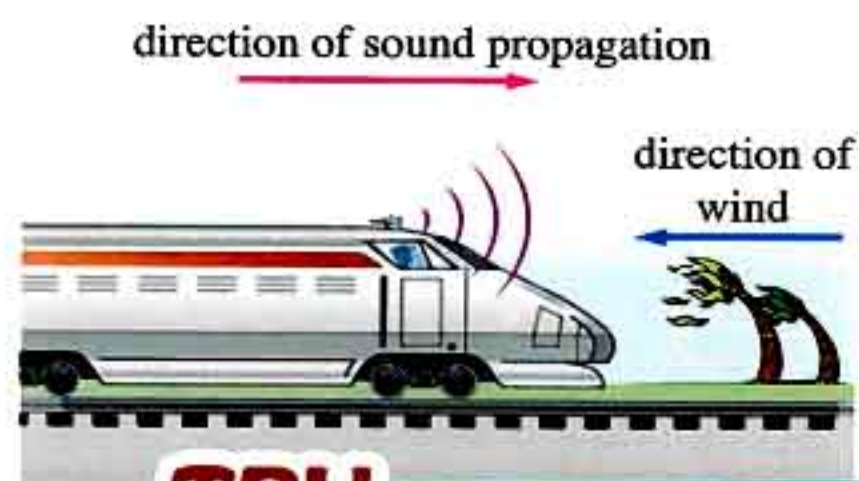
5

**Wind direction**

The intensity of sound **increases** when the direction of sound waves propagation is in the **same direction** of wind.



The intensity of sound **decreases** when the direction of sound waves propagation is in the **opposite direction** of wind.

**TRY**

TO ANSWER worksheet  
in the Notebook

7



UNIT  
2

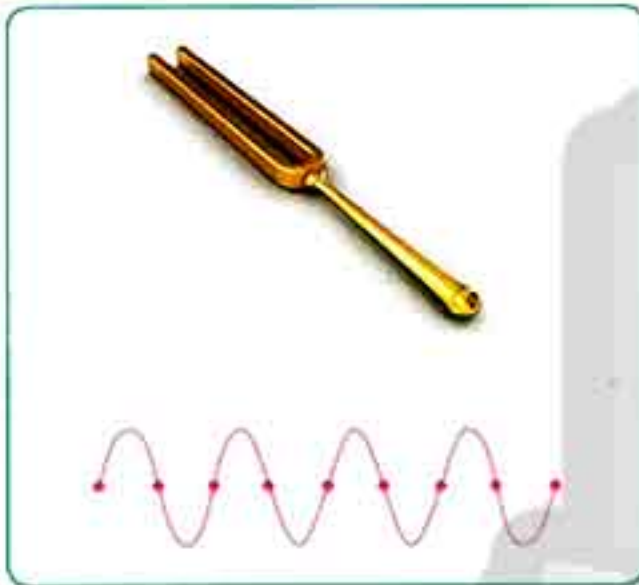
## 3

## Sound quality (type)

Sound quality (type):

It is the property by which the human ear can distinguish (differentiate) between different sounds according to the nature of the source even if they are equal in intensity and pitch.

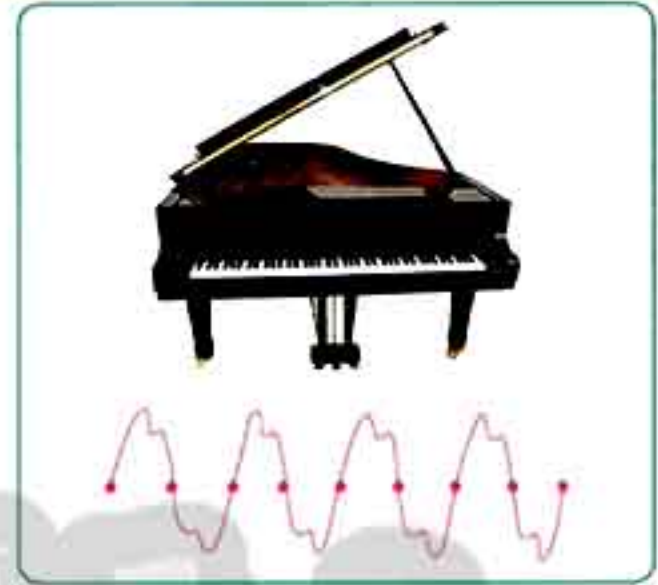
- \* **How can human ears distinguish between sounds from different sources [such as : tuning fork, violin and piano] :**



Tone produced from a vibrating tuning fork



Tone produced from a violin



Tone produced from a piano

- ➔ **To understand the quality of sound, notice this example :**

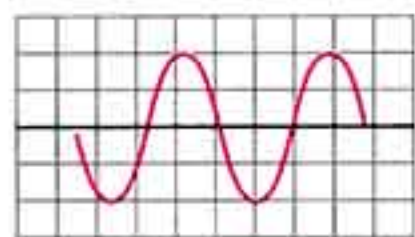
- The tone produced from a vibrating tuning fork is a pure simple tone known as the **fundamental (basic) tone**.

**On the other hand :**

- The tones produced from a violin or a piano even if they are equal in pitch and intensity, they are **complex tones**.
  - These **complex tones** : are composed of a **fundamental tone** associated by other tones higher in pitch and lower in intensity known as "**harmonic tones**".
  - These **harmonic tones** : differ from one source of sound to another depending on the nature of the sound source.

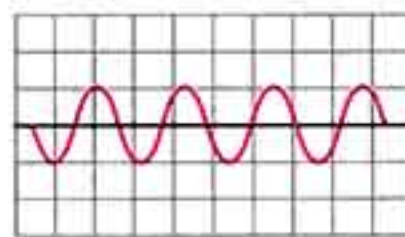
Harmonic tones:

They are tones that accompany the fundamental (basic) tone but they are higher in pitch and lower in intensity, and differ from one instrument to another.



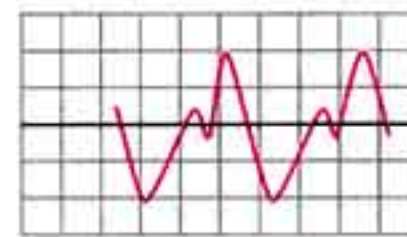
Fundamental tone  
(pure simple tone)

+



Harmonic tone  
(higher in pitch and  
lower in intensity)

=



Complex tone



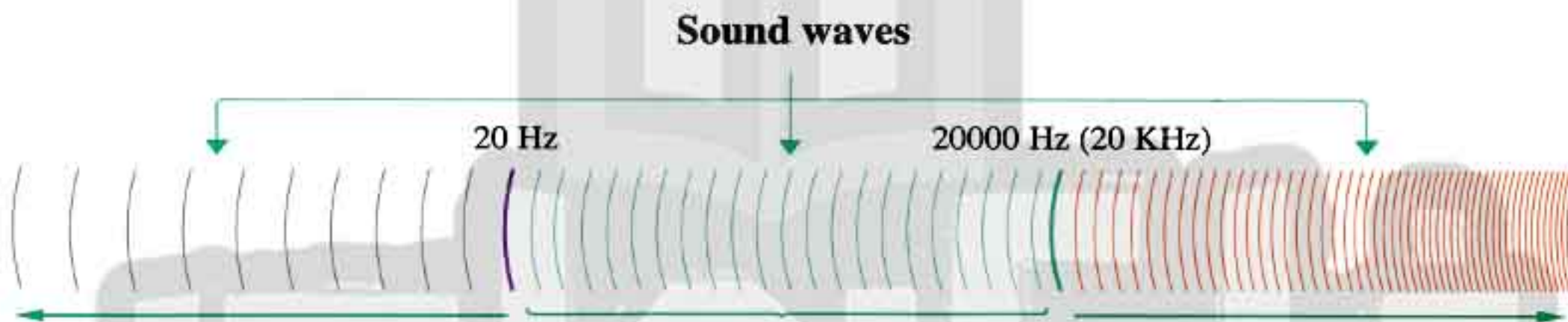


**The human ears distinguish between sounds from different sources even if they are equal in intensity and pitch.**

Due to the difference in the harmonic tones that associate the fundamental tone produced from the source of sound.

### Comparison between sound waves according to frequency :

- The human ears are affected by sounds of a frequency range between 20 Hz - 20 KHz.
- Based on the frequencies of sounds that the human ear recognize, sound waves are classified as in the following diagram :



#### **Infrasonic waves:**

They are sound waves of frequencies lower than 20 Hz.

#### **Example :**

The waves accompany the blowing of storms that precede rain fall and the human ear cannot hear them.



#### **Sonic waves:**

They are sound waves of frequencies ranging from 20 Hz to 20000 Hz (20 KHz).

#### **Example :**

The waves that human ear can distinguish between them and can hear them.



#### **Ultrasonic waves:**

They are sound waves of frequencies higher than 20000 Hz (20 KHz).

#### **Example :**

Some animal such as bats, dogs and dolphins can hear ultrasonic waves and the human ears cannot hear them.





UNIT  
2

GR.

- **The human ears can hear sounds of frequencies ranging from 20 to 20000 Hz.**

Because the ears transmit the effect of these waves to the brain, which translates them into sound and audible tones.

- **Some sound waves can't be heard.**

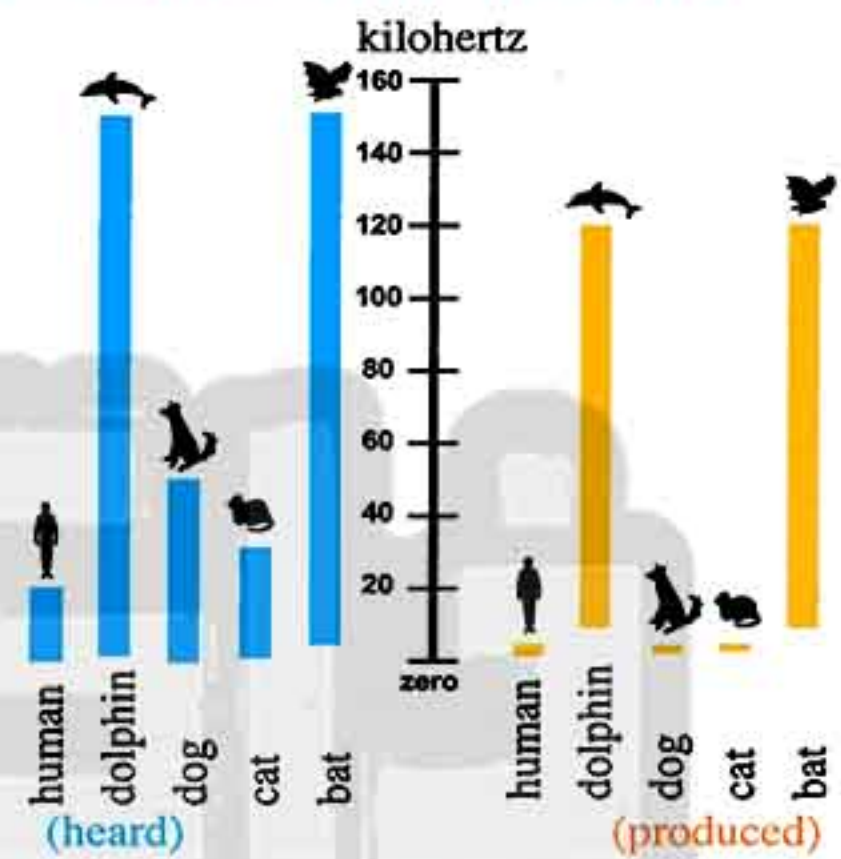
Because the frequencies of these waves are lower than 20 Hz or higher than 20000 Hz, so the human ears cannot hear them.

- ➔ **The opposite figure shows the range of the sounds produced and heard by some living organisms.**

From this figure, we notice that :

- ⊙ **Dogs can hear all sounds produced by man.**

Because man produces sounds of frequencies less than 20 kilohertz and dogs can hear sounds up to 50 kilohertz.



The range of sound heard and produced

- ⊙ **Man can't hear sounds produced by dolphins.**

Because dolphins produce sounds up to 120 kilohertz, while man can hear sounds of frequencies up to 20 kilohertz only.



### ► Enrichment information

- When the Ethiopian chickens that live in Africa depart their home suddenly, this gives an indication of rainfall the day after.
- This is explained by their high sensitivity to the infrasonic waves associating weather changes preceding rainfall.
- On the other hand, some sea creatures like shrimp and whales produce ultrasonic waves as sound shots to kill the fish they feed on.



Ethiopian chickens



## Lesson One



## Some Real Life applications of ultrasonic waves :

Ultrasonic waves are used in several medical, industrial and military fields such as :

### Field

### Uses

#### 1 Medical :

1. Breaking down kidney and ureter stones without any surgical interventions (operations).
2. Diagnosis of male prostate gland tumors and its effect on bladder.
3. Discovering malignant tumors.



Sonar

#### 2 Industrial :

Sterilization of food, water and milk as it is characterized by its high ability to kill some types of bacteria and stop the action of some viruses.



Milk sterilizer

#### 3 Military :

The discovery of landmines.



### ► Enrichment information

When ultrasonic waves collide with landmine, it vibrates. And due to this vibration it produces waves that travel through the earth's surface to be discovered by using a specialized laser device.

## TRY

TO ANSWER worksheet  
in the Notebook

8





# Remember

## ★ Sound :

It is an external factor (or stimulus) that affects the ear causing the sense of hearing.

## ★ Sound velocity :

It is the distance, which is covered by the sound waves in one second.

$$\text{Sound waves velocity (V)} = \text{Wave frequency (F)} \times \text{Wavelength (\lambda)}$$

## ★ The human ears can differentiate between the sounds through three different factors, which are :

1. Sound pitch.
2. Sound intensity.
3. Sound quality.

## ★ Sound pitch :

It is a property by, which the ear can distinguish between rough and sharp voices.

$$\text{Sound frequency (F)} = \frac{\text{Number of cycles (d)} \times \text{No. of gear teeth (n)}}{\text{Time in seconds (t)}}$$

## ★ Sound intensity :

It is the property, by which the ear can distinguish (differentiate) between sounds either strong or weak.

## ★ Factors affecting the sound intensity :

1. The distance between the ear and the sound source.
2. The amplitude of vibration of the sound source.
3. The area of the vibrating surface.
4. The density of the medium through, which the sound travels (propagates).
5. The direction of the wind.

## ★ The inverse square law of sound :

The intensity of sound at a point varies inversely with the square of the distance between that point and the sound source.

## ★ The intensity of sound :

- Is inversely proportional to the square of the distance between the sound source and the ear.
- Is directly proportional to the square of the amplitude of vibration of the sound source.
- Is directly proportional to the density of the medium, in which the sound passes or propagates.



## Lesson One

- Increases when the sound source touches a resonance body (box).
- Increases when the sound direction is in the wind flow direction and vice versa.

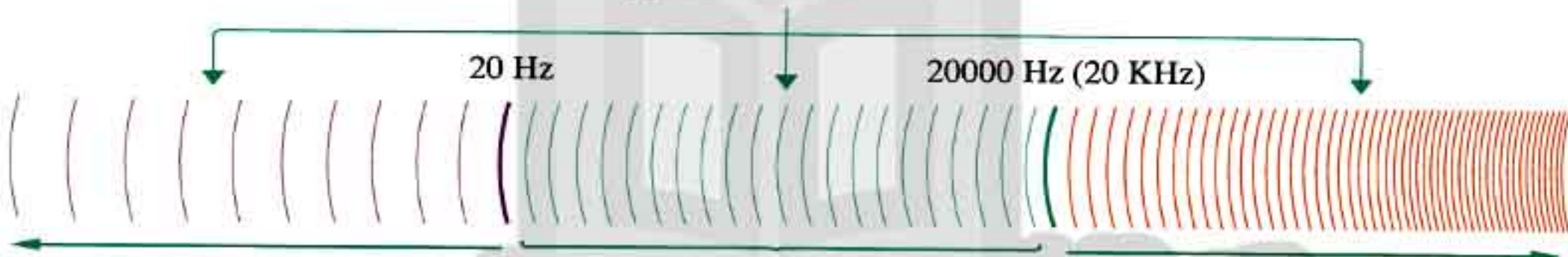
★ **Sound quality (type) :**

It is the property by which the human ear can distinguish between different sounds according to the nature of the source even if they are equal in intensity and pitch.

★ **Harmonic tones :**

They are tones that accompany the fundamental (basic) tone, but they are lower in intensity and higher in pitch and differ from one instrument to another.

**Types of sound waves**



**Infrasonic waves:**

They are sound waves of frequencies lower than 20 Hz

**Sonic waves:**

They are sound waves of frequencies ranging from 20 Hz to 20000 Hz (20 KHz)


**Ultrasonic waves:**

They are sound waves of frequencies higher than 20000 Hz (20 KHz)




# Questions

## on lesson one


Questions signed by  have been taken from the school book.

### 1. Choose the correct answer :

- Sound waves travel through .....  
a. solids.                      b. liquids.                      c. gases.                      d. (a) , (b) and (c).
- Sound waves do not travel through .....  
a. water.                      b. air.                      c. vacuum.                      d. wood.
- The sound produced from the school bell is considered as ..... waves.  
a. longitudinal                      b. electromagnetic  
c. transverse                      d. longitudinal and transverse
- All of the following indicate the nature of sound waves except that .....  
a. it's mechanical longitudinal waves.  
b. it propagates as spheres of compressions and rarefactions.  
c. its velocity through air is 430 m/s.  
d. no correct answer.
- Before using modern technology in communication, people in desert were putting their ears on the ground to hear the sound of horses of their enemies at very far places because .....  
a. sense of hearing is stronger than sense of vision.  
b. the velocity of sound through solids (ground) is greater than that through air.  
c. sound travels faster than light.  
d. sound of horses' feet is very loud.
- The sound velocity is measured in ..... unit.  
a. Hertz                      b. metre                      c. decibel                      d. metre/second
-  Sound wave that propagates through air with velocity 330 metre/sec. and of wavelength 0.1 metre, its frequency equals .....  
a. 330 Kilo Hertz.                      b. 3300 Hertz.  
c. 33 Kilo Hertz.                      d. 330 Hertz.
- All of these sounds are of uniform frequency except the sound of .....  
a. violin.                      b. guitar.                      c. loudspeakers.                      d. piano.
- The voice of Adham differs from that of Sara because they are different in .....  
a. age.                      b. intensity.                      c. pitch.                      d. kind.
- The human ears can often differentiate between the voice of the man and that of the woman, because .....  
a. the voice of a woman is often high pitch and sharp.  
b. the voice of a woman is often low pitch and sharp.  
c. the voice of a woman is often high pitch and rough.  
d. the voice of a man is often high pitch and sharp.



## Lesson One

11. The sound pitch increases by .....
- the decrease in frequency.
  - the increase in frequency.
  - the increase in amplitude.
  - the increase in the distance between the ear and the sound source.
12. We can prove that the pitch of sound depends on the frequency of vibration of the sound source by using ..... with knowing the number of cycles (turns) and the number of gear teeth.
- the resonance box
  - a stretched string of fixed length
  - Savart's wheel
  - the tuning fork
13. The frequency of the vibrating string ..... to its length.
- equals
  - is inversely proportional
  - is directly proportional
  - has no direct relation
14.  The sound of frequency 200 Hz is ..... than the sound of frequency 100 Hz.
- stronger
  - sharper
  - weaker
  - harsher
15. A student rotates Savart's wheel with different velocities, the velocity which gives more rough sound is .....
- 20 rotation/sec.
  - 300 rotation/min.
  - 6 rotation/sec.
  - 10 rotation/sec.
16. The frequency of sound produced from a plate touching a gear of 20 teeth in Savart's wheel when the wheel rotates 300 cycle/minute equals ..... Hz.
- 300
  - 15
  - 6000
  - 100
17. As the number of teeth of the gear in Savart's wheel increases, the ..... of the produced sound increases.
- amplitude
  - intensity
  - frequency
  - quality
18. As the velocity of the rotation of the gear in Savart's wheel decreases, frequency decreases, consequently the ..... of the sound decreases.
- pitch
  - type
  - amplitude
  - intensity
19. The frequency of the sound produced from Savart's wheel depends on .....
- the speed of rotation of the gear only.
  - the distance between the gear and you only.
  - the number of gear's teeth only.
  - (a) and (c) are correct.
20. The scientific term that expresses the strength and the weakness of sound is .....
- the frequency of sound.
  - the pitch of sound.
  - the quality of sound.
  - the intensity of sound.
21. The intensity of sound is directly proportional to .....
- the square of the distance from the source.
  - the square of the amplitude.
  - the distance from the source.
  - no correct answer.



UNIT  
2

22. The intensity of sound weakens as we go away from its source, because .....

- a.  $I \propto \frac{1}{d}$       b.  $I \propto d$       c.  $I \propto \frac{1}{d^2}$       d.  $I \propto d^2$

23. When the distance between the sound source and the ears is doubled, the sound intensity .....

- a. decreases to its half.      b. increases twice.  
c. increases four times.      d. decreases to its quarter.

24. The measuring unit of sound intensity is .....

- a. m/sec.      b. watt/m<sup>2</sup>.      c. decibel.      d. Hertz.

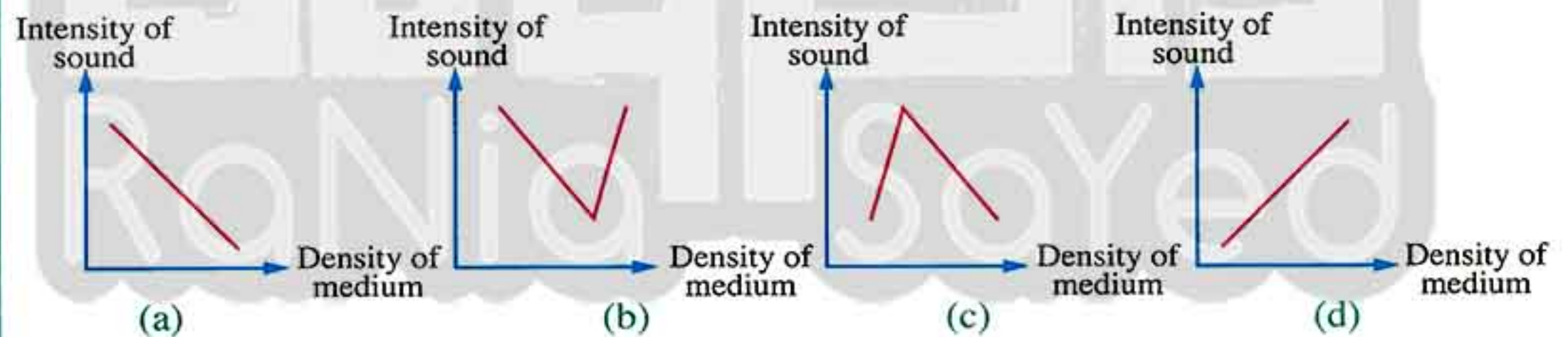
25. All of the following are factors affecting sound intensity except the .....

- a. amplitude of vibration.      b. medium density.  
c. frequency.      d. wind direction.

26. The resonance box increases the intensity of sound because it .....

- a. decreases the vibrating surface area.  
b. increases the vibrating surface area.  
c. increases the frequency of the produced sound.  
d. decreases the pitch of the produced sound.

27. The figure ..... represents the relation between the sound intensity and the density of the medium.



28. Sounds of different musical instruments can be differentiated from each other by .....

- a. frequency.      b. harmonic tones.      c. fundamental tone.      d. sound intensity.

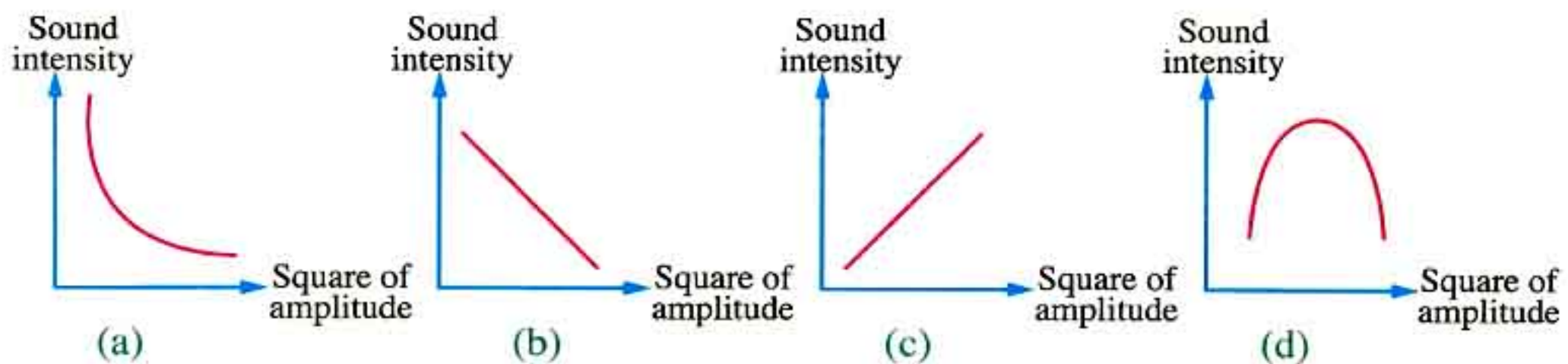
29. The human ear can distinguish between sounds that are equal in pitch and intensity if their sources are different, because the fundamental tone is accompanied by harmonic tones, which are .....

- a. higher in intensity and frequency.  
b. lower in intensity and higher in frequency.  
c. lower in intensity and frequency.  
d. higher in intensity and lower in frequency.



## Lesson One

30. The figure ..... represents the relation between the intensity of sound and the square of amplitude of vibration of a vibrating body.



31. .... waves are non-audible sounds.

- a. Infrasonic      b. Ultrasonic      c. Sonic      d. (a) and (b)

32. The human ear can hear sounds of frequency .....

- a. 50 KHz.      b. 30 KHz.      c. 300 Hz.      d. 5 Hz.

33. The dolphin's trainer uses a whistle producing a sound which can be heard by dolphins and cannot be heard by man, the frequency of such sound equals ..... Hertz.

- a. 20      b. 2000      c. 1000      d. 25000

34. A sound wave of frequency 30000 cycle/sec. is called ..... wave.

- a. sonic      b. infrasonic      c. ultrasonic      d. radio

35. The frequency of the point (X) is equal to ..... Hertz.

- a. 20      b. 20000  
c. 200      d. 2000

|                  |
|------------------|
| Ultrasonic waves |
| X                |
| Sonic waves      |
| Infrasonic waves |

36. Ultrasonic waves are used in .....

- a. breaking down kidney and ureter stones.      b. sterilizing food.  
c. discovering landmines.      d. (a), (b) and (c) are correct.

37. Doctors use waves, which have frequency ..... to break down kidney and ureter stones.

- a. less than 20 Hz      b. equal to 20 Hz      c. more than 20 KHz

## 2. Choose from column (B) the best match in column (A) :

| (A)                     | (B)   |
|-------------------------|---|
| 1. The sound pitch      | a. is the characteristic, by which the ear can differentiate between the sounds as strong or weak.  |
| 2. The quality of sound | b. is the property, by which the ear can distinguish between sharp and rough sounds.  |
| 3. The sound intensity  | c. is the number of the complete vibrations in one second.  |
|                         | d. is the characteristic, by which the ear can distinguish between sounds from different sources even if they are equal in intensity and pitch. |



## UNIT

## 2

## 3. Put (✓) or (✗) and correct the incorrect ones :


1. The sound of the electric bell is the highest when it is put under a bell jar evacuated from the air. ( )
2. The sound velocity through liquids is less than that through gases. ( )
3. If the speed of sound through air = 340 m/sec. and the frequency of a vibrating body = 170 Hz, so the wavelength = 2 metres. ( )
4. The human ears can distinguish between sounds through two different factors only sound pitch and sound type. ( )
5. As the length of the vibrating string decreases, the frequency of the produced sound increases. ( )
6. The type of sound depends on the distance between the ears and the sound source. ( )
7. The sound intensity becomes fainter gradually as we move towards the source of sound. ( )
8. As the distance between the ears and the sound source is doubled, the intensity of sound increases four times. ( )
9. As the amplitude of a vibrating body is doubled, the intensity of sound increases four times. ( )
10. The sound intensity decreases, when the source of sound touches an empty box. ( )
11. The intensity of sound will be stronger, if sound direction is against the air flow. ( )
12. The ear can distinguish between sounds of different sources of the same frequency and intensity by their fundamental tones. ( )
13. The sound quality is the property by which the ears can distinguish between strong and weak sounds. ( )
14. Sonic waves have frequencies ranging from 20 Hz to 20000 Hz. ( )
15. Sonic waves are used in sterilizing food substances. ( )
16. Sound wave of frequency 15000 Hz is audible sound. ( )

## 4. Write down the scientific term :

1. The external factor which affects the ears causing the sense of hearing.
2. Longitudinal waves produced due to the vibration of bodies and stop when the vibrating bodies stop their vibration.
3. The distance which is covered by the sound waves in one second.
4. A tone of regular frequency that is produced from reed pipe.
5. A tone of irregular frequency that is produced from loudspeakers.
6. • A property of sound by which the ears can distinguish between sharp and rough sounds.  
• A property of sound that is directly proportional to the frequency of the sound source.
7. An instrument used to determine the frequency of unknown sound tone.



## Lesson One

8. • The characteristic by which the ears can differentiate between strong and weak sounds.
  - The property of sound that is directly proportional to the square of the amplitude of vibration of the sound source.
9. Sound intensity at a certain point is inversely proportional to the square of the distance between this point and the source of sound.
10. The measuring unit of the sound intensity.
11. The measuring unit of noise intensity.
12. The material used for making ears plugs.
13. The property by which the human ears can distinguish between sounds from different sources even if they are equal in intensity and pitch.
14. The tones accompanying the fundamental tone but they are higher in pitch and less in intensity.
15.  Sound waves of frequencies less than 20 Hertz.
16. Sound waves of frequencies more than 20000 Hertz.
17. Sound waves of frequencies ranging between 20 to 20000 Hz.
18. Sound waves which accompany the blowing of storms that preceding rainfall.
19. Sound waves which are used in breaking kidney and ureter's stones.
20. Sound waves used for sterilization of the food and water.

### 5. Complete the following statements :

1. Sound originates from ..... of bodies.
2. Sound is considered from ..... waves , because it needs a medium to travel through.
3. Sound waves propagate through the medium as spheres of ..... and .....
4. Sound wave velocity = ..... × .....
5. The velocity of sound through solids is ..... than that through gases and its velocity through gases is ..... than that through liquids.
6. Sound wave which propagates through air with velocity 340 m/sec. and of frequency 20 Hertz, its wavelength equals .....
7. Musical tone is a sound of ..... frequency which is produced from ..... and .....
8. .... is a sound of ..... frequency, which is produced from electric digger.
9. Ear plugs made of ..... are used to avoid the hazards of ..... in loud places.
10. The human ears can differentiate between the sounds through three different factors, which are sound ....., sound ..... and sound .....
11. Sound of woman is ..... so it is said that she has ..... pitched sound.
12. Sound of a lion is ..... so it is said that he has ..... pitched sound.
13. Sharp tones have ..... frequencies, while rough tones have ..... frequencies.
14. The sound pitch depends on the ..... of the .....
15. The sound pitch is a property by which the ear can distinguish between ..... and ..... voices.






UNIT  
2




16. The frequency of the vibrating string is ..... proportional to its length.
17. Savart's wheel is used to determine the ..... of unknown sound tone.
18. When turning Savart's wheel with a speed of 600 rotation/minute, using a gear of 30 teeth, the frequency of the produced sound is .....
19. In Savart's wheel by using the same gear, the sound produced will be sharper by increasing its .....
20. In Savart's wheel, frequency =  $\frac{\text{No. of rotations} \times \dots}{\dots}$
21. Shouting is a sound of ..... intensity, while whispering is a sound of ..... intensity.
22. The measuring unit of the sound intensity is ..... , while that of noise intensity is .....
23. Among the factors affecting the sound intensity are ..... , ..... and .....
24. The intensity of sound at a certain point is measured by the quantity of sound energy falling ..... in one second on ..... at that point.
25. The sound intensity at a point is ..... proportional to the square of the distance between that point and the sound source, which is known as .....
26. When the distance between the sound source and the ear ..... two times, the sound intensity decreases ..... times.
27. When the amplitude of sound wave vibration is doubled, the intensity of sound ..... four times.
28. The sound intensity ..... by decreasing the density of the medium and ..... when the vibrating body touches a ..... box.
29. The intensity of sound ..... when the direction of sound waves propagation is in the opposite direction of wind.
30. The human ears can distinguish between sound from sources which are similar in frequency and intensity due to ..... tones which associate the ..... tone.
31. The fundamental tone is lower in ..... and higher in ..... than the harmonic tones.
32. The ..... of sound is a property by which the ears can distinguish between sound of different sources even if they are equal in ..... and .....
33. The frequency of sonic waves ranges between ..... Hz and ..... Hz, while the frequency of infrasonic waves is ..... Hz and also, the frequency of ultrasonic waves is ..... Hz.
34. The human ears can't detect the sound waves of frequencies less than ..... and that of frequencies more than .....
35. .... sound waves accompany the blowing of storms that preceding rainfall.
36. Some animals such as ..... , ..... and ..... can hear ultrasonic waves.
37. .... waves are used in medical diagnosis and in breaking ..... and ..... stones.



**6. Give reasons for :**

1. The explosions occurred on the Sun surface cannot be heard on the Earth.
2. The guardian dog puts its ears on the ground when it sleeps at night.
3. Sound can be heard from all surrounding directions.
4. The violin player changes the length of strings during his play.
5. The difference in frequency between the musical note (tone) and noise.
6. The tuning fork of frequency 251 Hz gives rougher sound than that produced by another tuning fork of 512 Hz.
7. When you use Savart's wheel, you change the speed of wheel rotation.
8. The intensity of sound decreases four times as the distance between the ears and sound source is doubled.
9. The intensity of sound decreases as the amplitude of the vibrating source decreases.
10. The intensity of sound increases when the sound source touches a resonance box.
11. The sound intensity which produced from a vibrating ruler will be decreased as time passes.
12.  Sound travelling in air has less intensity than that travelling in carbon dioxide.
13.  The piano sound differs from that of the violin even if they have the same intensity and pitch.
14. The human ears can hear sounds of frequencies ranging from 20 Hz to 20000 Hz.
15. Dogs can hear all sounds produced by man.
16. Man can't hear all sounds produced by dolphins.
17. Some sound waves cannot be heard by man.
18. The infrasonic waves are used for weather forecast.
19. •  The use of ultrasonic waves in milk sterilization.  
• Ultrasonic waves are used to sterilize food and water.
20. The ultrasonic waves have medical uses.

**7. What is meant by each of the following ?**

- |  |   |
|--|---|
| 1. Sound.  | 2. The velocity of sound.   |
| 3.  The wavelength of a sound wave = 1.5 m. | 4.  Sound pitch. |
| 5. Sound intensity.  | 6. Decibel.   |
| 7. Sound quality.  | 8. Inverse square law of sound.   |
| 9.  Sonic waves.                            | 10. Infrasonic waves.   |
| 11. Ultrasonic waves.  | 12. Harmonic tones.   |

**8. What happens when ... ?**

1. You decrease the length of the violin string during playing (concerning the frequency).
2. The number of rotations per second of Savart's wheel increases.
3. The distance between the sound source and the ears increases twice.
4. You move gradually towards a sound source.
5. The amplitude of vibrations of a sound source decreases.



UNIT  
2

6. You put a vibrating tuning fork on a resonance box.
7. Operating an electric bell under a bell jar connected to a vacuum pump, then pump the air out of the jar gradually.
8. The sound direction is in the direction of air flow.
9. The sound direction opposes the direction of air flow.
10. The frequency of sonic waves decreases less than 20 Hz.
11. The frequency of sonic waves increases more than 20000 Hz.

**9. What does these relations indicate ?**

1.  $\frac{\text{Distance covered by a sound wave}}{\text{Time in seconds}}$
2.  $\frac{\text{Number of rotations}}{\text{Time in seconds}} \times \text{Number of gear teeth in Savart's wheel}$
3. Sound intensity (I)  $\propto \frac{1}{\text{Square of the distance between the ear and the sound source (d}^2\text{)}}$
4. Sound wave frequency  $\times$  Wavelength

**10. Mention an activity to show :**

1. Sound pitch depends on its frequency.
2. Sound intensity increases when the sound source touches a resonance box.
3. The effect of medium density on sound intensity.

**11. Problems :**

1. A sound source produces 3600 cycles in 3 minutes. If its wavelength is 17 meters, find the velocity of this sound waves.
2. Calculate the wavelength of a sound wave of frequency 17 Hz, if the distance travelled by this wave in one second is 340 metres.
3. Savart's wheel rotates with a rate of 300 cycles per minute. A sound of frequency 600 Hz. is produced when an elastic plate touches the teeth of one gear. Calculate the number of teeth of the gear.
4. Calculate the number of the gear teeth of Savart's wheel, given that the frequency of the sound produced is 100 Hz. and the wheel rotates 30 cycles/min.
5. Find the number of rotations in 2 minutes made by Savart's wheel producing sound of frequency 300 Hz, if a metallic plate touches one gear of 100 teeth.
6. Savart's wheel produces a sound of frequency 200 Hz. when a metallic plate touches a gear having 50 teeth. Find the time in minutes taken by the wheel to make 360 rotations.


**12. Variant questions :**


- (1) Mention the factors on which the sound intensity depends. Show the relation between the sound intensity and each factor.




## Lesson One

(2) Write down the mathematical relation that joins between each of the following :

1. Frequency, sound velocity and wavelength.
2.  The sound frequency and the number of teeth of the gear in Savart's wheel.

(3)  Mention one function or importance of Savart's wheel.

(4)  What is the scientific basis on which the following depends ?

The strings of the musical lute are fixed on a hollow wooden box.

(5) Mostafa rotates three toothed gears of Savart's wheel which differ in the number of their teeth as shown in the following table and he touches each gear alone by a thin metal plate :

| Gear            | The first | The second | The third |
|-----------------|-----------|------------|-----------|
| Number of teeth | 50        | 90         | 115       |

Answer the following questions :

1. The roughest sound is produced when the metal plate touches the ..... gear.
2. Calculate the frequency of sound produced when the metal plate touches the second gear which has 90 teeth and rotates by a rate of 200 cycles/min.

(6) Compare between sonic, ultrasonic and infrasonic waves.

From the point of view of :

- Their frequencies.
- Hearing by man.

(7) A person stands near an apparatus producing different sounds.

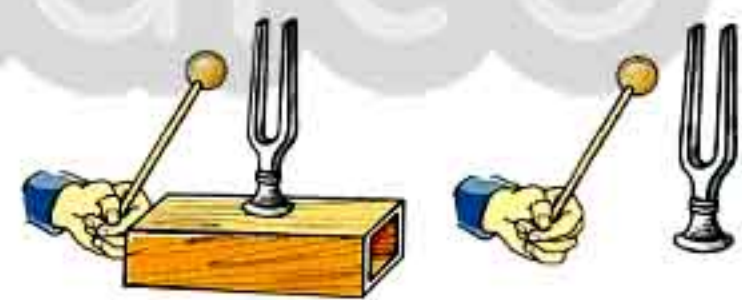
It produces sounds of the following frequencies : 10 Hz, 15 Hz, 25 Hz, 50 Hz and 25000 Hz, which of these sounds will be heard by man ? Why ?

(8) Sonar instrument produces ultrasonic waves :

1. What are the frequencies of such waves ?
2. Mention four uses of such waves.

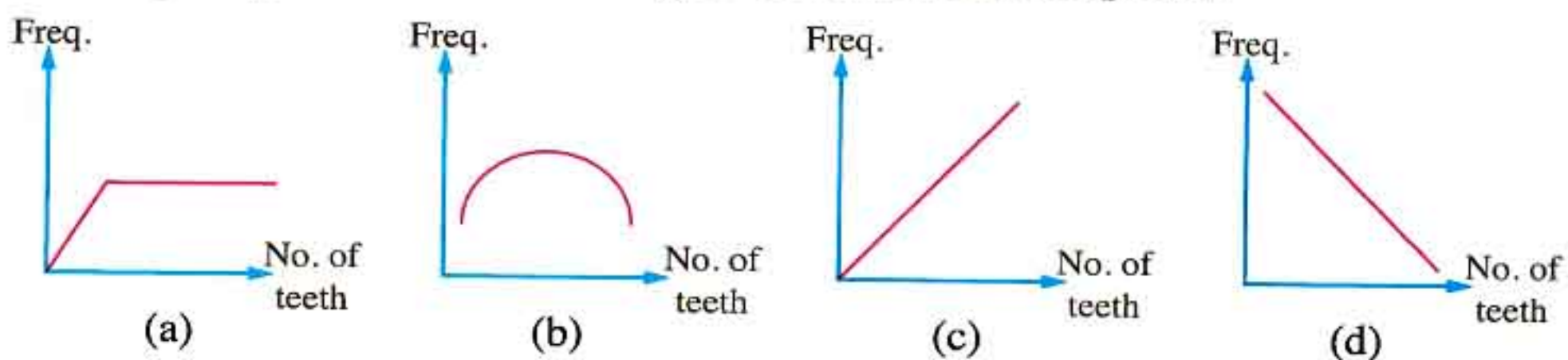
(9) Ahmed knocking on a tuning fork which installed on a resonance box, and when he repeated this step without using a resonance box he found that the produced sound is different in the two cases.

\* Is this difference in the sound pitch or in the sound intensity ? Give a reason.



13. Study the following figures, then answer the questions :

(1) In Savart's wheel, which of the following graphs represents the relation between the frequency and the number of gear teeth at constant speed ?

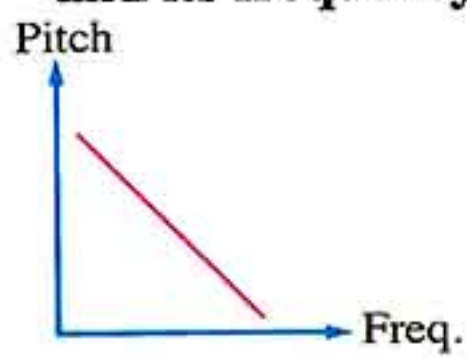




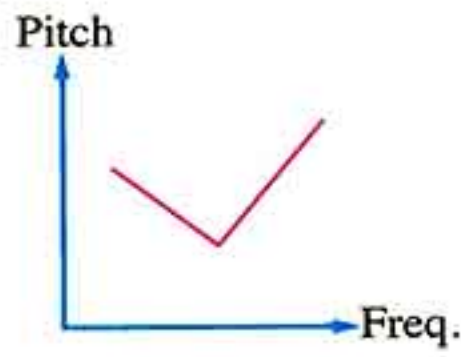
## UNIT

## 2

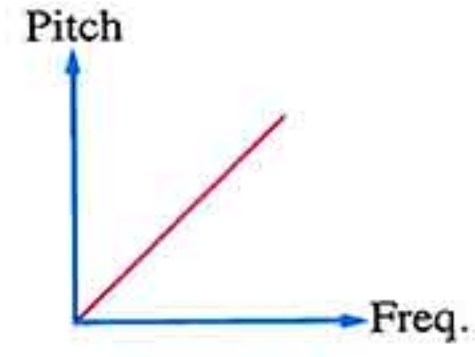
(2) Which of the following graphs represents the relation between the pitch of a sound and its frequency ? Why ?



Graph (1)

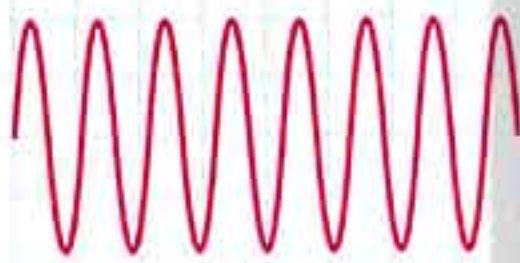


Graph (2)

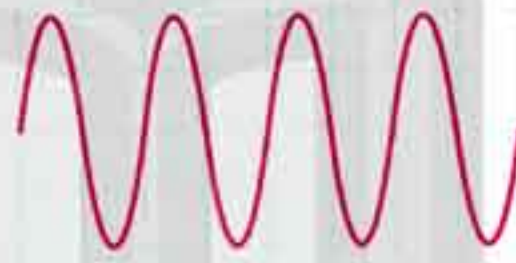


Graph (3)

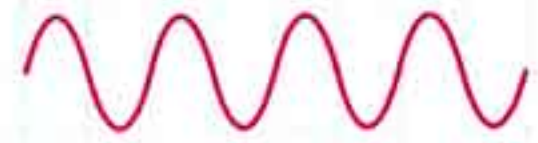
(3) Using the following figures, compare from the point of view of sound intensity and pitch between.



Wave (A)



Wave (B)



Wave (C)

1. Sound wave (A) and sound wave (B).
2. Sound wave (B) and sound wave (C).

(4) Hoda pulled a stretched string from the middle as in the figure :

Hoda showed that the sound intensity is to be strong at case .....

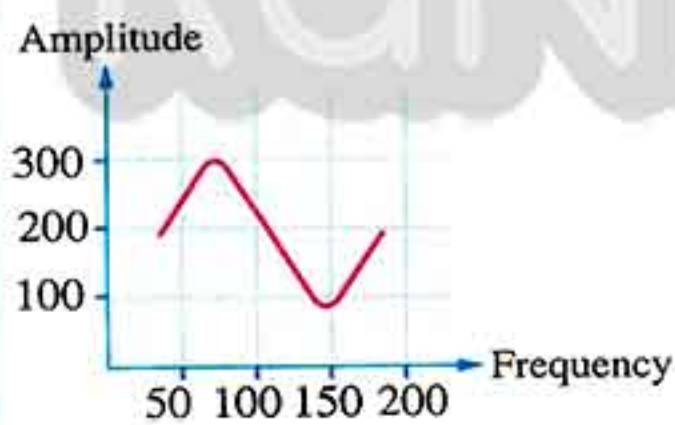


(a) Small amplitude

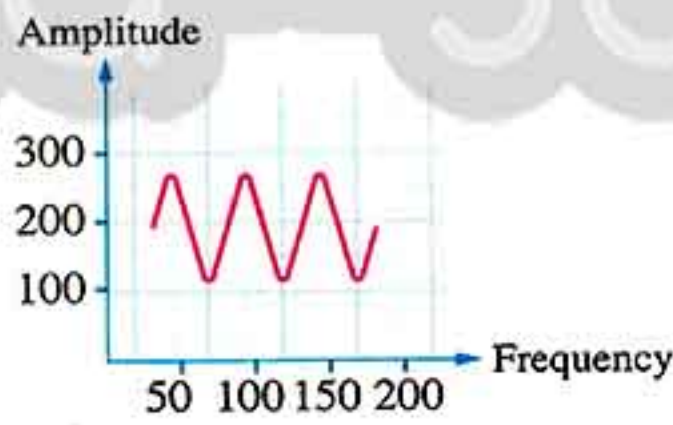


(b) Large amplitude

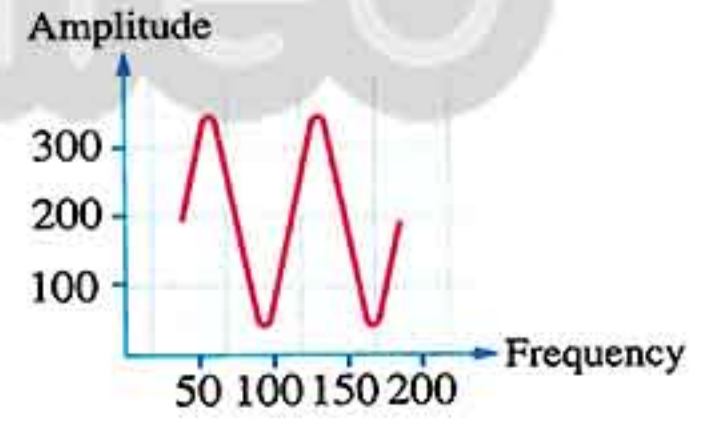
(5) The following graphs represent three different sound waves :



(a)



(b)



(c)

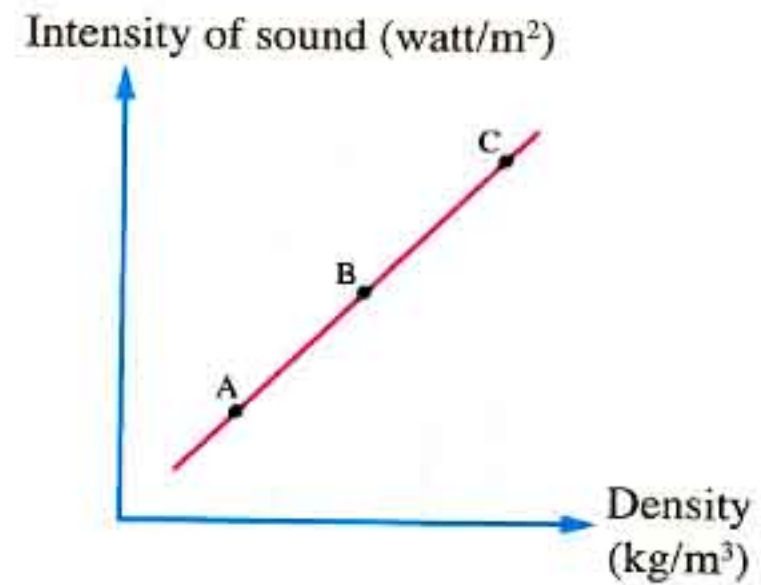
1. Which figure has the largest amplitude ?
2. Which figure represents a sharper tone ? Why ?
3. Which figure represents a harsher tone ? Why ?
4. Which figure represents sound of higher intensity ? Why ?
5. Complete :
  - a. As the amplitude increases, the sound becomes .....
  - b. As the frequency of sound decreases, the sound becomes of .....



## Lesson One

(6) During an experiment to find the relation between the density of media (A, B and C) and the intensity of sound, complete :

1. The medium which gives strong sound is .....
2. The medium which gives faint sound is .....



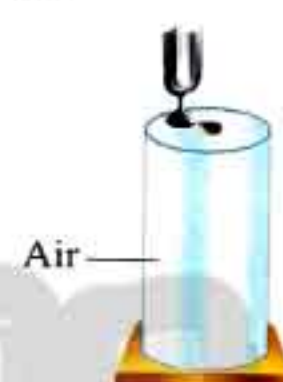
(7) There are three jars of volume  $100 \text{ cm}^3$ , the 1<sup>st</sup> is full of water of density  $1 \text{ gm/cm}^3$ , the 2<sup>nd</sup> is full of oil of density  $0.8 \text{ gm/cm}^3$  and the 3<sup>rd</sup> is full of air of density  $0.01 \text{ gm/cm}^3$ . Tap a tuning fork of known frequency and touch the stopper of each jar, so :



(a)



(b)



(c)

1. The sound of the highest intensity is the jar number ..... (Give a reason)
2. The factor affecting the intensity of sound in this case is .....

(8) Study the given table and answer the following questions :

1. Complete the following :

- (1) The frequency of point (X) is ..... Hz.
- (2) The frequency of point (y) is ..... Hz.

2. Choose :

- (1) Frequency is ..... in area (1).

a. 15 Hz      b. 22 Hz      c. 2000 Hz      d. 25000 Hz

- (2) Frequency is ..... in area (2).

a. 15 Hz      b. 22 Hz      c. 25000 Hz      d. 30000 Hz

- (3) Frequency is ..... in area (3).

a. 15 Hz      b. 22 Hz      c. 2000 Hz      d. 25000 Hz

- (4) Dogs and dolphins can hear ..... waves.

a. infrasonic      b. sonic      c. ultrasonic      d. (a) and (b)

- (5) Bats can hear ..... waves.

a. infrasonic      b. sonic      c. ultrasonic      d. (a) and (c)

- (6) Medical diagnosis instruments are made by using waves in ..... area.

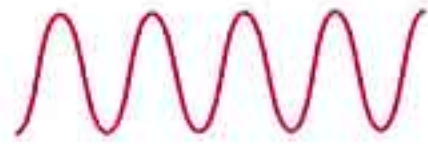
a. first      b. second      c. third      d. (a) and (b)

| Area | Waves            |
|------|------------------|
| 3    | Ultrasonic waves |
| y    |                  |
| 2    | Sonic waves      |
| X    |                  |
| 1    | Infrasonic waves |

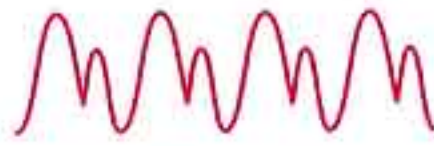


UNIT  
2

(9) The following figures refer to three different sound waves.



Wave (a)



Wave (b)

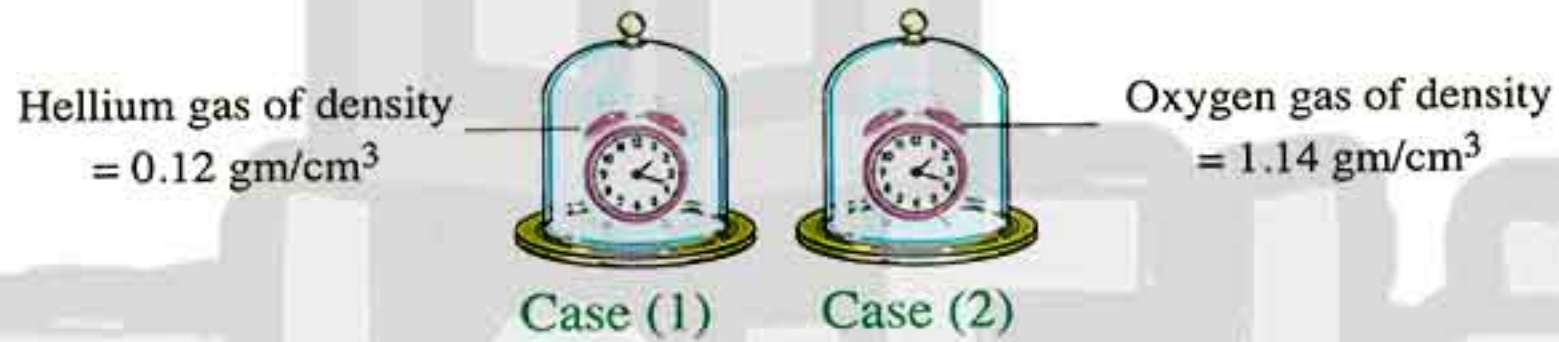


Wave (c)

Choose from these waves the wave produced from (give a reason) :

1. Tuning fork.
2. Hammer.
3. Musical instrument.

(10) Compare between the sound intensity of alarm in the opposite two cases, Give a reason.





# Timss Questions



1. Calculate the wavelength of a wave produced by tuning fork vibrates in air if its tone is matched with a tone produced from Savart's wheel which rotates 1800 cycles / 2 minutes known that the number of its gear tooth is 34 teeth.
2. If tooth number of a Savart's wheel gear is 50 teeth and it rotates 300 cycles/min. to produce a certain tone. What is the number of rotation in 1.5 minutes of another wheel to produce the same tone if its gear tooth number is 60 teeth ?
3. Calculate the ratio between sound intensity at two points far from the sound source by 2 m , 6 m.
4. Suppose that there is an electromagnetic wave and another sound wave have the same frequency. Which of them has longer wavelength ? Why ?
5. Calculate the ratio between the frequencies of two different tones produced from Savart's wheel at the same period of time if you know that the number of teeth of the two gears of the wheel is 60 , 80 and the number of cycles of each of them in the experiment is 80 , 90 respectively.
6. If the sound intensity of sound produced from a source at a distance (d) meter from a person = (I) watt/m<sup>2</sup> so the sound intensity at a distance  $(\frac{1}{2} d) = \dots\dots\dots I$   
 a.  $\frac{1}{4}$                       b.  $\frac{1}{2}$                       c. 1                      d. 4
7. Give a reason for :  
 The intensity of sound when firing a shot on mountain top is less than it on the base of the mountain.



## Wave Nature of Light



## What

is the nature of light waves, and what are its properties?

*Light is a form of energy, and when it reflected from objects and falling on eyes it causes vision.*

Light:


It is an external factor (or stimulus) that affects the eye causing the sense of vision.

## In this lesson, we will study :

1. Nature of light waves.
2. Analysis (or splitting) of white light.
3. Energy of light waves.
4. Light behaviour through different media.
5. Light travels in straight lines.
6. Light intensity (brightness).

## 1

## Nature of light waves :

- Light waves are electromagnetic transverse waves .
- They are **electromagnetic waves**, because they propagate through vacuum and they are **transverse waves**, because the medium particles vibrate perpendicular to the direction of the wave propagation forming crests and troughs.
- The velocity (speed) of light waves through vacuum (free space) = 300000 km/sec. ( $3 \times 10^8$  m/sec.).

The speed of light:

It is the distance covered by light in one second.

$$\text{Speed} = \frac{\text{Distance [m]}}{\text{Time [sec]}}$$



## Lesson Two

## Problems

- 1 Calculate the distance between the Earth and the moon, if you know that the reflected Sunlight on the moon's surface reaches the Earth after 1.3 sec.

## Solution

$$\therefore \text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\therefore \text{Distance} = \text{Time} \times \text{Speed}$$

$$\therefore \text{Speed of light through vacuum} = 3 \times 10^8 \text{ m/sec.}$$

$$\begin{aligned} \therefore \text{The distance between the Earth and the moon} &= 3 \times 10^8 \times 1.3 = 3.9 \times 10^8 \text{ m} \\ &= 3.9 \times 10^8 \times 10^{-3} = 3.9 \times 10^5 \text{ km} \end{aligned}$$



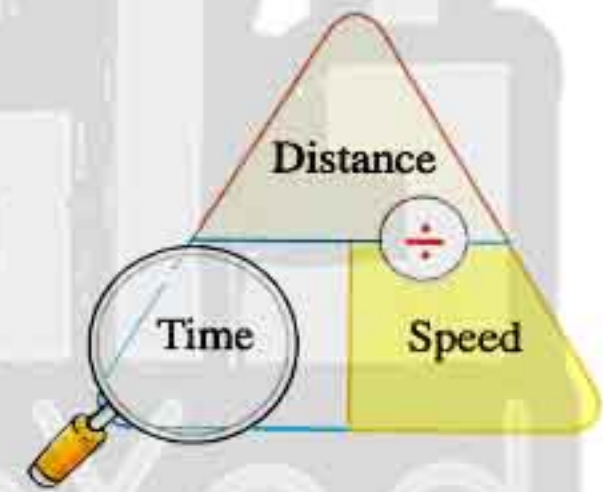
- 2 How much time it takes for light to cover the distance equal  $3 \times 10^8 \text{ m}$  in the space?

## Solution

$$\therefore \text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\therefore \text{Time} = \frac{\text{Distance [m]}}{\text{Speed [m/sec]}}$$

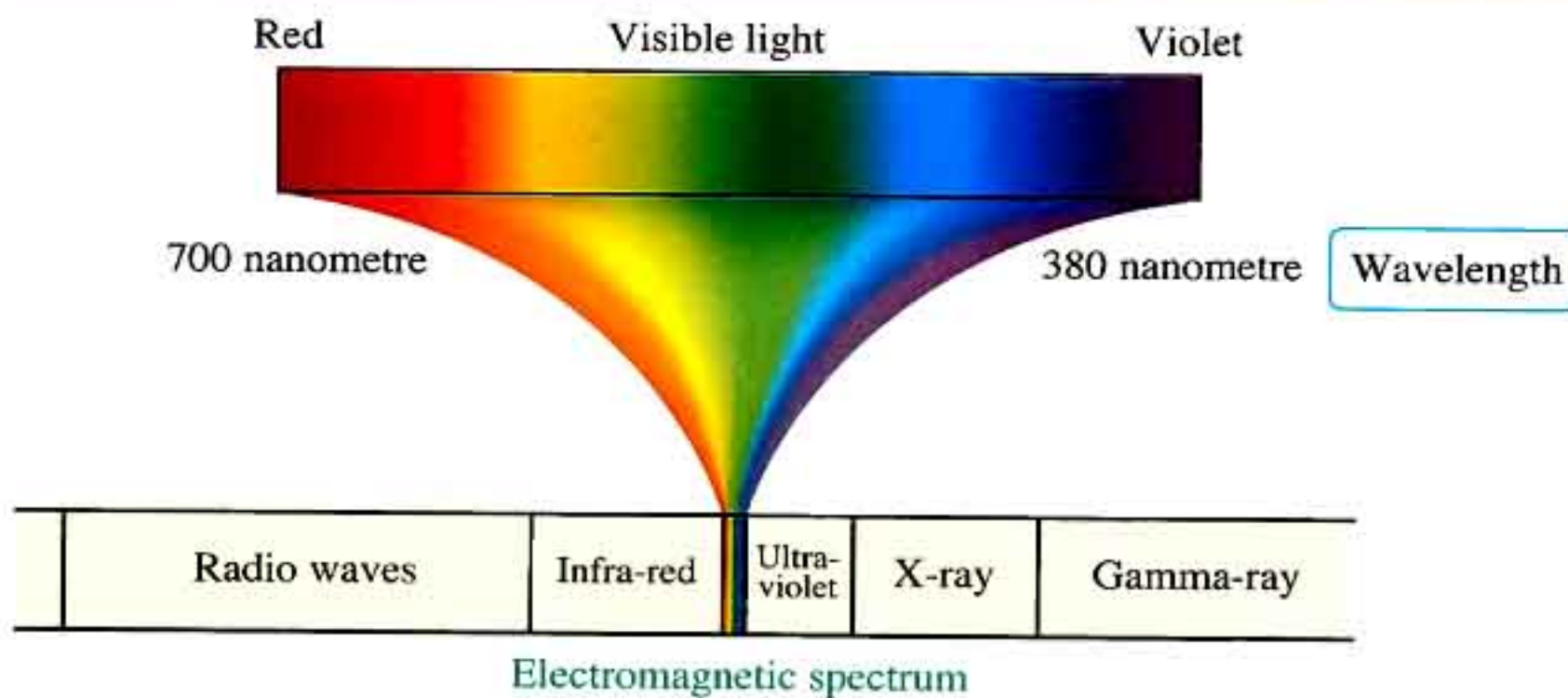
$$\therefore \text{Time} = \frac{3 \times 10^8}{3 \times 10^8} = 1 \text{ sec.}$$



From the opposite figure, we can define the visible light as follows :

The visible light:

It is one of the components of electromagnetic spectrum of wavelength ranges between 380 : 700 nanometres.





UNIT  
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## ► Enrichment information

*Al-Hassan Ibn Al-Haitham was the first scientist who :*

- established the science of light.
- discovered the pin hole box which helped in developing the optical camera.
- explained how vision occurs.

2

## Analysis (or splitting) of white light :



The Sun is the main source of light energy on the Earth's surface.

## Analysis of white light:

It is the splitting of white light into seven colours called spectrum colours.

1. If you put a compact disc (CD), on a table, whose glistening surface faces sun rays (a source of white light).
2. You observe the formation of seven colours.
3. This is due to the analysis of white light into seven colours.



Compact discs

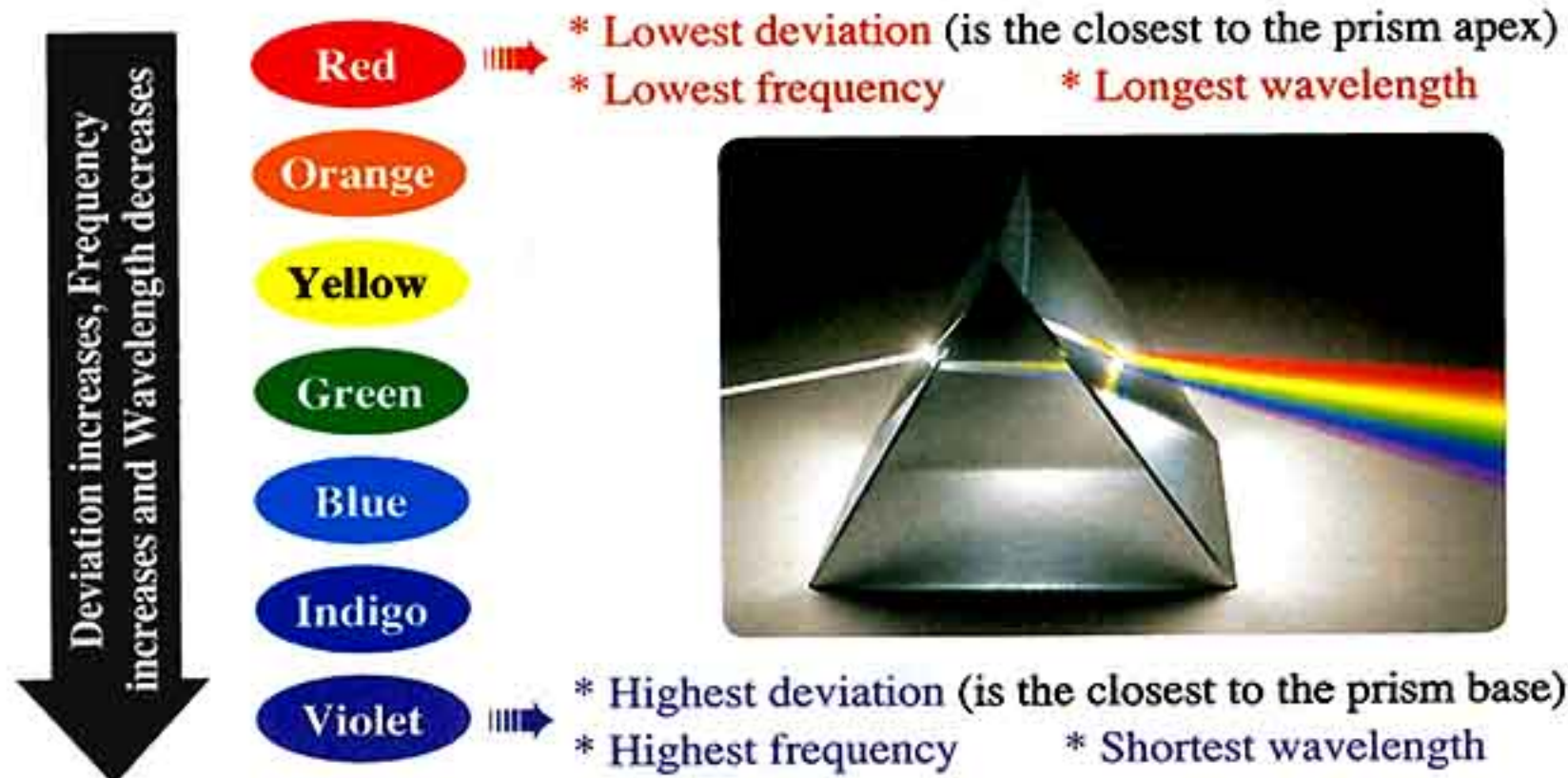
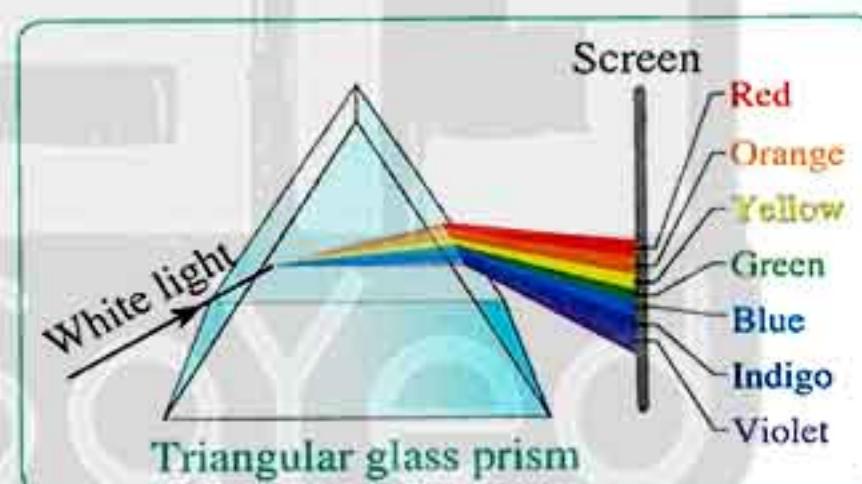
- White light consists of a mixture of seven colours which are known as "Spectrum colours".

- These colours are : Red - Orange - Yellow - Green - Blue - Indigo - Violet.

\* Similarly, when the white light falls on a triangular glass prism, it is analysed into seven spectrum colours which are constant in speed and different in :

- Wavelength.      - Frequency.      - Angle of deviation.

(As in the figure).





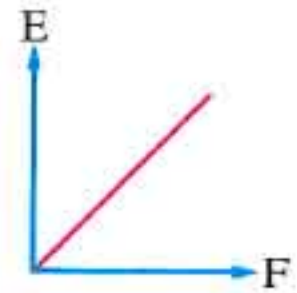
## Lesson Two

3

## Energy of light waves :

The German scientist **Max Planck** proved in 1900 that the energy of light waves is composed of energy quanta known as "**Photons**".

- The energy of the photon (E) is directly proportional to the frequency of the light wave (F).



$$\text{Photon energy} \propto \text{Photon frequency}$$

$$\text{Photon energy} = \text{Constant} \times \text{Photon frequency}$$

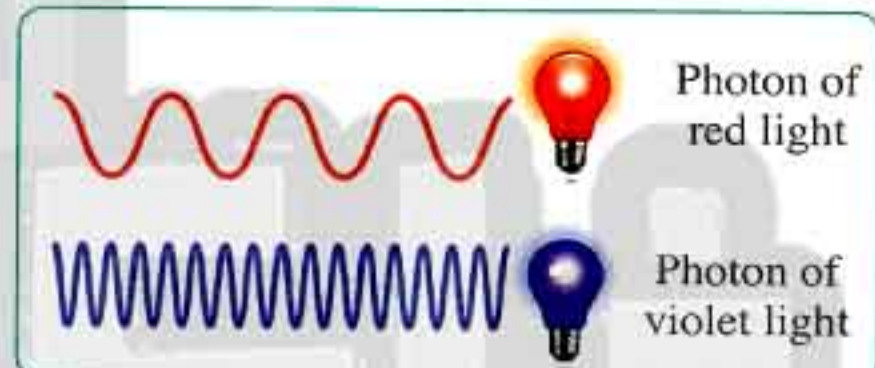
- The constant value is known as **Planck's constant**.

$$\text{Photon energy} = \text{Planck's constant} \times \text{Photon frequency}$$

## Exercise 1

Which one has a greater energy, the photon of red light or the photon of violet light ?

Given that the frequency of red light is less than that of violet light.



## Answer

The energy of the photon of red light is smaller than the energy of the photon of violet light, because the energy of the photon is directly proportional to the frequency.



## Real Life applications : of the uses of light :

- Light is used in home decorations like :

TRY

TO ANSWER worksheet  
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9

## Spot lights :



That illuminate artifacts.

## Ornamented lamps :



That bring happiness  
and joy to the place.

## Stand lamps :



That concentrate light  
for reading.



UNIT  
2

4

## Light behaviour through different media :

Light transmits through different media with variable degrees.

So, Media can be classified according to their ability to allow light to pass through, into :

## A Transparent medium.

**Transparent medium:**

It is the medium, which permits most light to pass through.

Objects can be seen clearly through transparent medium.

**Examples :**

- The clear glass in a window.
- Air.
- Pure water.
- A glass cup.



By increasing the thickness of the transparent medium, the quantity of light that passes through it decreases.



## B Translucent (semi-transparent) medium.

**Translucent medium:**

It is the medium, which permits only a part of light to pass through and absorbs the remaining part.

Objects can be seen through translucent medium less clearly than the transparent one.

**Examples :**

- Flint glass.
- Tissue paper.



## C Opaque medium.

**Opaque medium:**

It is the medium, that doesn't permit light to pass through.

Objects can't be seen through opaque medium.

**Examples :**

- Plant leaves.
- Foil paper.
- Milk.
- Metals.
- Cartoon.
- Human skin.
- Black honey (molasses).
- Books.
- Wood.





## Lesson Two

## ? Give a reason ?

- (1) The clothes pins can be seen clearly before and after placing them in a transparent plastic bag. Because both of air and transparent plastic bag are transparent media, which allow light to pass through it.



- (2) When we put the crayons in desk tirm made of flint glass, the upper part of it is visible, while the bottom does not look as clear.

The upper part of crayons is visible, because the air is transparent media allow light to pass through it, while the bottom does not look as clear, because of the flint glass is translucent medium, which permits only a part of light to pass through and absorbs the remaining part.



- (3) When a free leaf is placed on the title of the book we can not see it.

Because the tree leaf is an opaque medium that does not permit light to pass through it.



- (4) Not seeing the impurities that may found (exist) in black honey.

Because the black honey is an opaque medium that does not permit light through it.



- (5) Although water is a transparent medium, we cannot see fish at the bottom of the River Nile. Because the thickness of water at that point (the bottom) is large enough to prevent light from passing through.

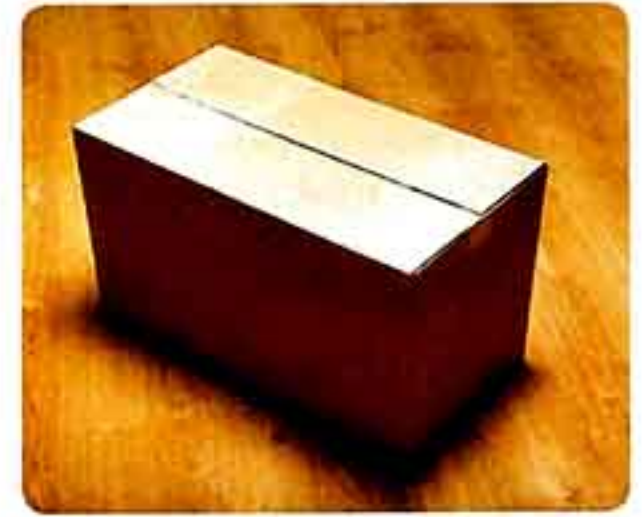




UNIT  
2

(6) Carton is an opaque medium.

Because it doesn't permit light to pass through and objects can't be seen inside it.



## ? What happens when ?

Several transparent plastic strips are put on a sheet of graph paper "for the clearness of visibility"

- Clearness of visibility of the sheet of graph paper decreases gradually until it can't be seen, according to the number of the transparent plastic strips and its thickness, when they increase the quantity of light that passes through it decreases.



## ? Exercise 2

Compare between transparent, translucent and opaque media :

| Points of comparison | Transparent medium | Translucent medium | Opaque medium |
|----------------------|--------------------|--------------------|---------------|
| Definition :         | .....              | .....              | .....         |
| Examples :           | .....              | .....              | .....         |

5

## Light travels in straight lines :

Light propagates (travels) through transparent media in straight lines whose thickness can be controlled.



Light travels in straight lines





## ACTIVITY 1

To demonstrate (show) the propagation of light in straight lines :



### Materials and tools :

- Four cards.
- Pieces of clay.
- White paper plate.
- Light pen.

| Steps   | Figures           | Observations  |
|---|-------------------|---|
| 1. Make identical holes in the three cards [A , B , C] (as shown in figure 1).<br>2. Fix the four cards using clay on the white paper plate, where the holes lie on straight line.<br>3. Allow light of the light pen to pass through the hole of card (A). | <p>Figure (1)</p> | <ul style="list-style-type: none"> <li>• The light ray passes through the holes in straight line and a light spot is formed on the card (D).</li> </ul> |
| 4. Repeat the previous steps by replacing the cards with others have wider holes (as shown in figure 2).  | <p>Figure (2)</p> | <ul style="list-style-type: none"> <li>• The area of the formed light spot increases by increasing the size of the holes.</li> </ul>                    |
| 5. Move the card (B) to the left (as shown in figure 3).  | <p>Figure (3)</p> | <ul style="list-style-type: none"> <li>• The light ray cannot pass through the card (B), so a light spot disappears on the card (D).</li> </ul>         |



### Conclusion :

Light travels through transparent media in the form of straight lines, whose size (thickness) can be controlled.

### ► Enrichment information

*Solar and lunar eclipses can be explained according to the travelling of light in straight lines.*



UNIT  
2

6




## Light intensity (brightness) :



## ACTIVITY

2

- To illustrate the concept of light intensity.
- To show the light intensity of a surface changes by changing the distance between the surface and the light source.

| Steps   | Figure  | Observation  |
|---|---|--|
| 1. Stand at 1 m away from a wall in a dark room and direct the light of a torch towards it.         |   | The light intensity of the light spot formed on the wall decreases as the distance between you and the wall increases. |
| 2. Increase the distance between you and the wall to 2 metres, then 3 metres. What do you observe ? |  |  |
|   |   |  |



## Explanation :

The light emitted from a light source propagates in all directions and as the distance between the wall and the light source increases, the quantity of light incident on the unit area of the surface decreases.



## Conclusion :

The quantity of light falling perpendicular to a unit area of a surface in one second is called "Light intensity".

## Light intensity:

It is the quantity of light falling perpendicular to a unit area of a surface in one second.

Light intensity of a surface decreases as the distance between the surface and the light source increases.





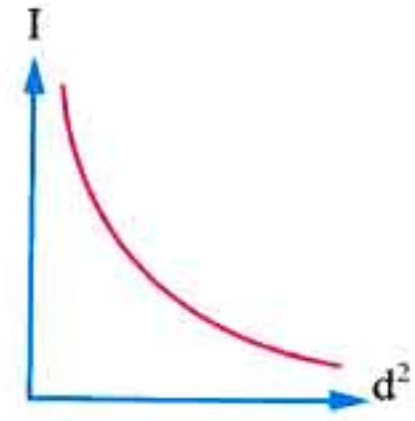
## Lesson Two

➤ From the previous activity, we can conclude the inverse square law of light :

### The inverse square law of light:

The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light.

$$\text{Light intensity} \propto \frac{1}{d^2}$$



### ? What happens when ?

The distance between the light source and a certain surface is doubled ?

➤ The light intensity decreases to its quarter.

The distance between the light source and a certain surface decreases to half ?

➤ The light intensity increases to four times.

GR.

**The intensity of light increases four times when the distance between the light source and the wall decreases to its half value.**

Because the light intensity is inversely proportional to the square of the distance between them.

### ► Enrichment information

Some people prefer to install mercury lamps in the headlights of their cars, as they give much brighter illumination that can penetrate fog. But, when this bright light is used at night, it can cause some visual impairment to the drivers coming in the opposite direction.

**TRY**

TO ANSWER worksheets  
in the Notebook

10 & 11





# Remember

## ★ Light :

It is an external factor which affects the eye causing the sense of vision.

## ★ The speed of light :

It is the distance covered by light in one second.

## ★ The visible light :

It is one of the components of electromagnetic spectrum of wavelength ranges between 380 : 700 nanometres.

## ★ Analysis of white light :

It is the splitting of white light into seven colours called spectrum colours.

## ★ Energy of light wave :

$$\text{Photon energy} = \text{Planck's constant} \times \text{Photon frequency}$$

## ★ Transparent medium :

It is the medium which permits most light to pass through it.

## ★ Translucent medium :

It is the medium which permits only a part of light to pass through it and absorbs the remaining part.

## ★ Opaque medium :

It is the medium that doesn't permit light to pass through it.

## ★ Light intensity :

It is the quantity of light falling perpendicular to a unit area of a surface in one second.


## ★ The inverse square law of light :

The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light.



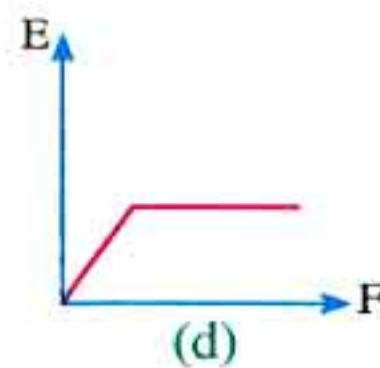
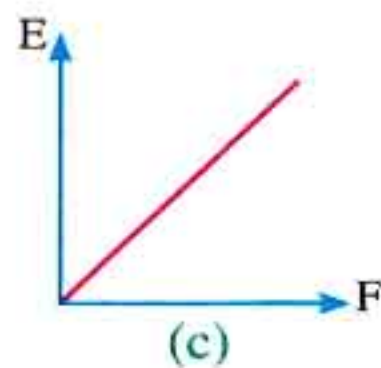
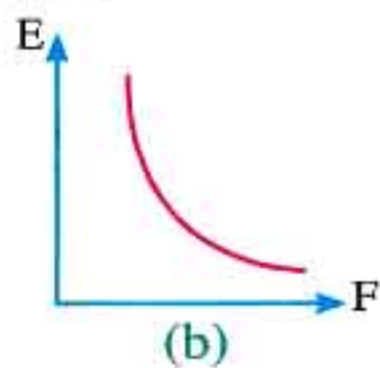
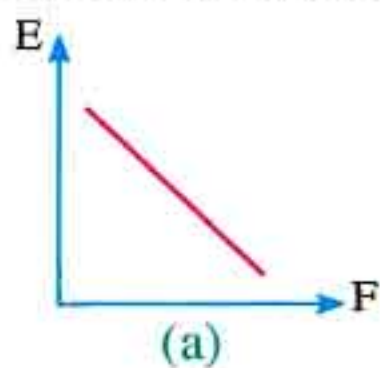
# Questions

## on lesson two

Questions signed by  have been taken from the school book.



### 1. Choose the correct answer :

- Light waves are ..... waves.
  - mechanical transverse
  - electromagnetic transverse
  - electromagnetic longitudinal
  - mechanical longitudinal
- Which of these characteristics is not applied on light ? .....
  - It is an electromagnetic wave.
  - It needs a medium to travel through.
  - It travels in straight lines.
  - It has the ability to stimulate the sense of vision.
- The distance that light travels in a second is .....
  - light frequency.
  - light speed.
  - light intensity.
  - no correct answer.
- The main source of light on the Earth's surface is the .....
  - Sun.
  - Moon.
  - Star.
  - Candle.
- White light consists of ..... spectrum colours.
  - nine
  - six
  - seven
  - eight
- ..... colour has the lowest deviation.
  - Violet
  - Green
  - Red
  - Yellow
- The ..... colour in the spectrum colours has the highest frequency.
  - violet
  - green
  - red
  - yellow
- If the frequency of red colour is  $4 \times 10^{12}$  Hz, the frequency of violet colour is .....  $\times 10^{12}$  Hz.
  - 1.5
  - 3.5
  - 4
  - 7.5
- The photon energy = Planck's constant  $\times$  .....
  - photon frequency.
  - photon wavelength.
  - amplitude.
  - no correct answer.
- The quanta of ..... colour has the lowest energy.
  - blue
  - violet
  - green
  - red
- Which of the following graphs represents the relation between the frequency of light (F) and its energy (E) ? .....





UNIT  
2

12.  The quantum of energy of green light is ..... the quantum of energy of yellow light.  
a. greater than      b. equal to      c. less than      d. no correct answer
13. Which of the following arrangements is correct concerning the increase of photon energy ? .....  
a. Violet → blue → yellow → red  
b. Red → blue → violet → yellow  
c. Violet → red → blue → yellow  
d. Red → yellow → blue → violet
14. All of the following are among the characteristics of violet colour except .....  
a. it has the highest frequency of the spectrum colours.  
b. it has the longest wavelength of the spectrum colours.  
c. its photon has the largest energy.  
d. it is the nearest colour to the base of the prism.
15. The medium which permits most light to pass through is called ..... medium.  
a. transparent      b. translucent      c. semi-transparent      d. opaque
16. Media that we can see objects less clearly through are called .....  
a. opaque media.      b. transparent media.      c. translucent media.      d. spectrum colours.
17. .... media don't allow light to pass through.  
a. Transparent      b. Translucent      c. Semi-transparent      d. Opaque
18. All of the following are examples of transparent media except .....  
a. air.      b. tissue paper.      c. glass.      d. clear water.
19. Which one from the following doesn't permit the passage of light through it ? .....  
a. Air.      b. Clear water.      c. Flint glass.      d. Milk.
20. Light can be easily transmitted through ..... media.  
a. transparent      b. semi-transparent      c. opaque      d. (a) and (b)
21.  The human skin is considered as a /an ..... medium.  
a. transparent      b. opaque      c. translucent      d. no correct answer
22. By increasing the thickness of the transparent medium, the quantity of light that passes through it .....  
a. decreases.      b. increases.  
c. remains constant.      d. there is no correct answer.
23. Light travels in ..... lines.  
a. curved      b. circular      c. straight      d. no correct answer
24. Light .....  
a. travels in straight lines.      b. consists of compressions and rarefactions.  
c. can be analysed.      d. (a) and (c) are correct.



## Lesson Two


25. The light intensity of a surface is inversely proportional to the ..... between the surface and the source of light.
- a. distance  
b. square of the distance  
c. cube of the distance  
d. (a) or (b) is correct
26. When the distance between the source of light and the surface of a wall decreases, the light intensity on the surface .....
- a. decreases.  
b. increases.  
c. is doubled.  
d. remains constant.
27. If the distance between a surface and light source decreases to its half, the light intensity of the surface .....
- a. decreases to its one fourth.  
b. decreases to its half.  
c. increases twice.  
d. increases four times.

## 2. Rewrite the following statements after correcting the mistakes :

1. Light is a mechanical transverse waves.
2. The velocity of light through space is 30000 km/sec.
3. White light is a mixture of five colours known as bright colours.
4. The glass prism is used to analyse the white light into nine spectrum colours.
5. The frequency of the green light is lower than that of yellow light.
6. Violet colour has the longest wavelength.
7. Yellow colour is the first colour in spectrum colours, but violet colour is the last one.
8. Al-Hassan Ibn Al-Haitham proved that the energy of light waves is composed of photons.
9. Energy of the photon = Planck's constant + Frequency of the photon.
10. The energy of the quanta of light is directly proportional to the wavelength of the light wave.
11. The media can be classified according to their ability to transmit light into transparent and opaque media only.
12. Transparent media allow a part of light to pass through them.
13. Air and pure water are examples of translucent media, but tissue paper and flint glass are examples of opaque media.
14. Milk, wood and cartoon are examples of transparent media.
15. The objects can be seen clearly through translucent media.
16. By increasing the thickness of the transparent medium, the quantity of light that passes through it increases.
17. Light travels in transparent media in the form of zigzag lines.
18. The intensity of light on a surface increases as the distance between the source of light and the surface increases.
19. The intensity of light on a surface is directly proportional to the distance between the light source and the surface.
20. As the distance between light source and a surface decreases to its one third, the intensity of light increases 3 times.



**3. Write the scientific term of each of the following :**

1. Electromagnetic waves stimulate the sense of vision when they reach the eye.
2. The distance covered by light in one second.
3. One of the components of the electromagnetic spectrum of wavelength ranges between 380 : 700 nanometres.
4. The main source of light energy on the Earth surface.
5. The splitting of white light into seven spectrum colours.
6. A mixture of seven spectrum colours.
7. A structure used in the analysis of light.
8. Seven colours are produced as a result of splitting of the white light.
9. The scientist who proved that the energy of the photon depends on its frequency.
10. • The colour which has the lowest frequency, longest wavelength and lowest energy.  
• The colour which has the lowest deviation and it is the closest to the prism apex.
11. • The colour which has the highest frequency, shortest wavelength and highest energy.  
• The colour which has the highest deviation and it is the closest to the prism base.
12. A physical quantity equals Planck's constant is multiplied by frequency.
13.  A medium doesn't allow light rays to penetrate through.
14. The media allow the passage of light through them.
15. The media allow the passage of a part of light through them and absorb the remaining part.
16. The amount of light falling perpendicular to a unit area of a surface in one second.
17. The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light.

**4. Complete the following statements :**


1. Light is ..... waves that travel through free space (vacuum).
2. Visible light is one of the components of electromagnetic spectrum of wavelength ranges between ..... to ..... nanometres.
3. The light velocity is the distance .....
4. .... is the main source of light energy on Earth's surface.
5. Light waves consist of ..... and .....
6. White light consists of ..... colours.
7. The glass prism is used to analyse the ..... light into ..... colours.
8. .... , orange , ..... , green , blue , ..... and violet are the seven spectrum colours.
9. .... is the nearest colour to the prism apex, while ..... is the nearest colour to the prism base.
10. The ..... colour has the highest frequency and the shortest wavelength, while the ..... colour has the lowest frequency and the longest wavelength.



## Lesson Two


11. The frequency of blue colour is ..... than the frequency of yellow colour, so the energy of yellow light photon is ..... than the energy of blue light photon.
12. The scientist ..... proved that the energy of light waves is composed of energy quanta known as .....
13. The energy of the photon is ..... proportional to the ..... of light wave.
14. Energy of photon = .....  $\times$  .....
15. Light is used in home decorations like ..... to illuminate artifacts and ..... to concentrate light for reading.
16. Media are classified according to their ability to allow light to pass through into ..... medium , ..... medium and ..... medium.
17. The medium which allows most light to pass through is called .....
18. .... and ..... are examples of the transparent media.
19. The glass cup is an example of transparent medium , while flint glass is an example of ..... medium.
20. Cartoon and ..... are examples of ..... medium that don't permit light to pass through.
21. By increasing the ..... of the transparent medium , the quantity of light that passes through it .....
22. Light travels through the ..... media in ..... lines.
23. The light intensity is the amount of light .....
24. The light intensity of a surface is ..... proportional to square of the distance between the surface and the light source.
25. As the distance between the light source and the surface increases twice, the intensity of light of the surface ..... to its .....

### 5. Give reasons for :



1. Light can travel through free space.
2. Light waves are considered as electromagnetic waves.
3. Formation of spectrum colours.
4. The light of the Sun is a complex light.
5.  The energy of red light photon is less than that of orange light photon.
6. The energy of violet photon has the maximum energy in spectrum colours.
7. The energy of violet photon is larger than that of blue photon.
8. Objects can be seen clearly through transparent medium.
9. Objects cannot be seen clearly through the frosted glass.
10. A clear glass is a transparent medium.
11. A tissue paper is a translucent medium.
12. Aluminium foil is an opaque medium.




UNIT  
2

13. Wood doesn't allow the passage of light through it.
14.  The inability to see the impurities present in black honey.
15. The intensity of light of a surface decreases to its quarter as the distance between the surface and light source is doubled.

**6. What is meant by ... ?**

1. Light.
2. The velocity of light is  $3 \times 10^8$  m/sec.
3.  Visible light.
4. Analysis of light.
5. Transparent medium.
6. Translucent medium.
7. Opaque medium.
8.  Light intensity.
9. The inverse square law of light.

**7. What happens when ... ?**

1. A compact disc (CD) with shiny side is put to face sunlight.
2.  Incidence of a white light ray on one face of a triangular glass prism.
3. The thickness of the transparent medium increases concerning the quantity of light that passes through it.
4. Light falls on a transparent medium.
5. Light falls on a translucent medium.
6. Light falls on an opaque medium.
7. You look at a picture through a clear glass in a window.
8. You look at a picture through a frosted glass.
9. You look at a picture through a metallic sheet.
10. The distance between the source of light and a surface increases concerning the light intensity.
11. The distance between the light source and a surface is doubled concerning the light intensity.

**8. Choose the unsuitable word or statement out, then express the rest of the words or statements with something proper :**

1. Yellow / Blue / White / Violet / Red.
2. Glass / Ceramic / Water / Air.
3. Frosted glass / Tissue paper / Clouds / Water.
4. Wood / Concrete / Air / Metal.
5. Light travels in straight lines / The speed of light differs in different media / White light consists of seven spectrum colours / Light travels through materialistic media only.



## Lesson Two

## 9. Explain an activity to :

1. Demonstrate that light travels in straight lines through transparent media.
2. Show the light intensity of a surface changes by changing the distance between the surface and the light source.

## 10. Variant questions :

## (1) Arrange the spectrum colours ascendingly according to :

- a. Frequency.
- b. Deviation in the triangular prism.

## (2) Mention the use(s) of :

- a. Light.
- b. Triangular glass prism.

## (3) Write down the mathematical relation that joins between :

The photon frequency of a wave and its energy.

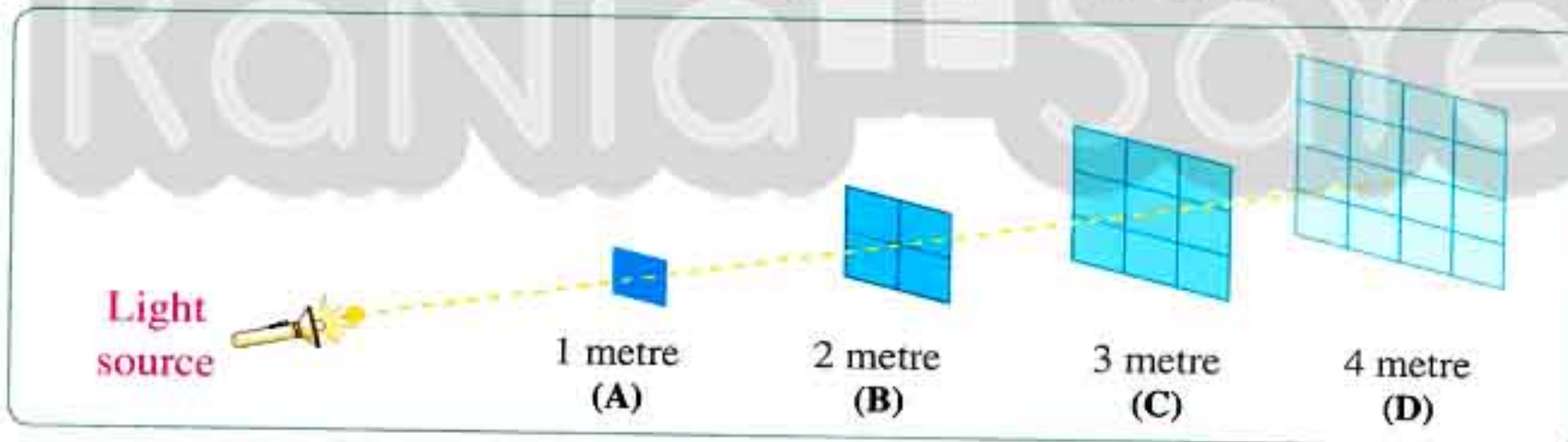
## (4) Compare between : Transparent medium, translucent medium and opaque medium.

## 11. Study the following figures, then answer the questions :

## (1) In the following figure, the light intensity of the surface at point (A) equals the unity.

Choose from the following values :  $(\frac{1}{2} - \frac{1}{3} - \frac{1}{4} - \frac{1}{6} - \frac{1}{9} - \frac{1}{12} - \frac{1}{16})$

What is suitable to be the light intensity at the points, (B) , (C) and (D) ?

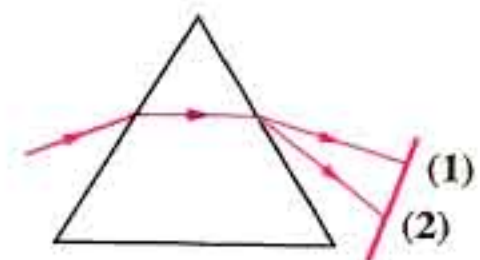


## (2) Look at the opposite figure, then answer :

1. The figure shows the separation of ..... into ..... by .....
2. Mention the names of the spectrum colours in the right order.



## (3) In the opposite figure. Which ray represents the red colour and which ray represents the violet colour ?

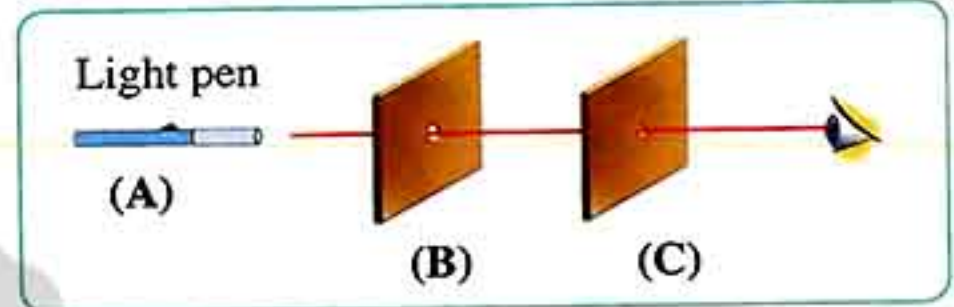




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(4) Study the following figure, then answer the following questions :

1. Light is one of the energy forms and its energy depends on the frequency of its waves, so the lowest frequency is ..... colour, while the highest frequency is ..... colour. *(Complete)*
2. The given drawing is for an activity proves that light travels in ..... *(Complete)*
3. What will happen if we move part (C) slightly to the right ?
4. Copy the drawing in your answer sheet using an arrow to show the direction of light propagation.



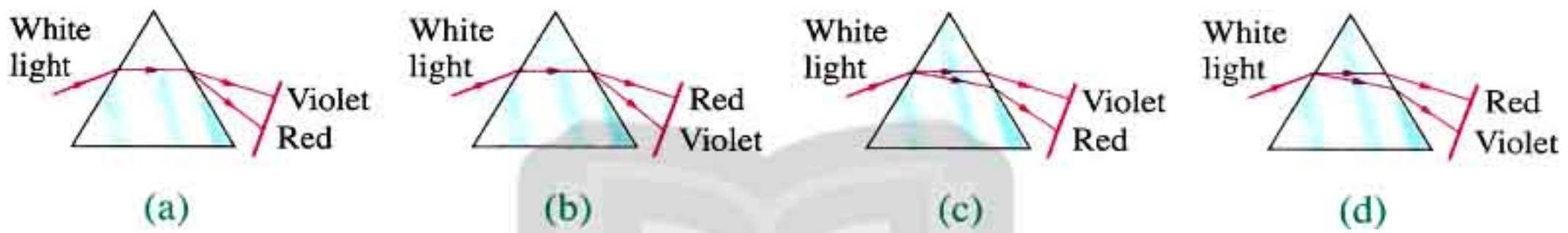


# Timss Questions

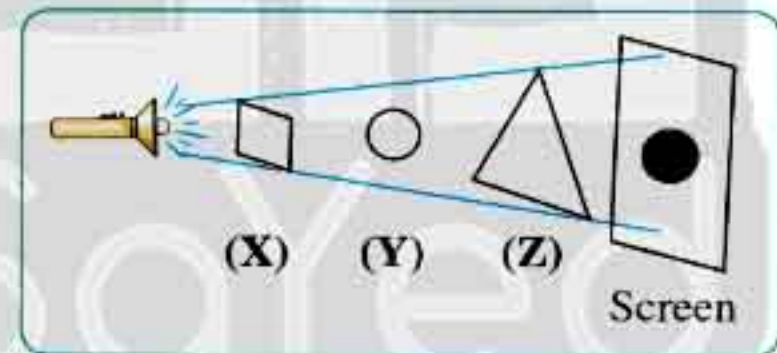


## 1. Choose the correct answer :

1. The figure ..... represents the analysis of white light by a triangular glass prism.



2. The ratio between the frequency of red light to the frequency of violet light is ..... one.
- a. more than      b. equal to      c. less than
3. The periodic time of green light wave is ..... the periodic time of red light wave.
- a. more than      b. equal to      c. less than
4. In the following figure, the shadow formed on the screen indicates that (X) , (Y) and (Z) are made of ..... respectively.
- a. iron , flint glass and transparent plastic  
b. glass , rubber and cartoon  
c. cartoon , plastic and glass  
d. transparent glass , rubber and transparent plastic



2. Mercury lamp is preferred in headlights of cars. Give a reason.

3. If the distance between the Earth and the Sun is  $1.5 \times 10^8$  km, Calculate the time taken by sunlight to reach the Earth in minute unit.



## Reflection and Refraction of Light



## Why

we can see an inverted image of a building on the surface of water ?

From the previous lesson you studies that light travels in straight lines and it does not permits through dark objects, so the result is the formation of shadows.

In this lesson, we will talk about two basic concepts of light which are:

1. Light reflection.

2. Light refraction.

1

## Light reflection :

- Sometimes, in our daily life, we can observe the formation of inverted images of trees and buildings on the surface of water or on the road when rain falls.
- When you throw a ball against a wall, it returns back (rebounds) from the wall.

Similarly when light meets a reflecting surface, it rebounds again and this is known as "light reflection".

- The surface, at which the reflection takes place is called the "reflecting surface".



## Light reflection :

It is the rebounding (returning back) of light waves in the same medium on meeting a reflecting surface.

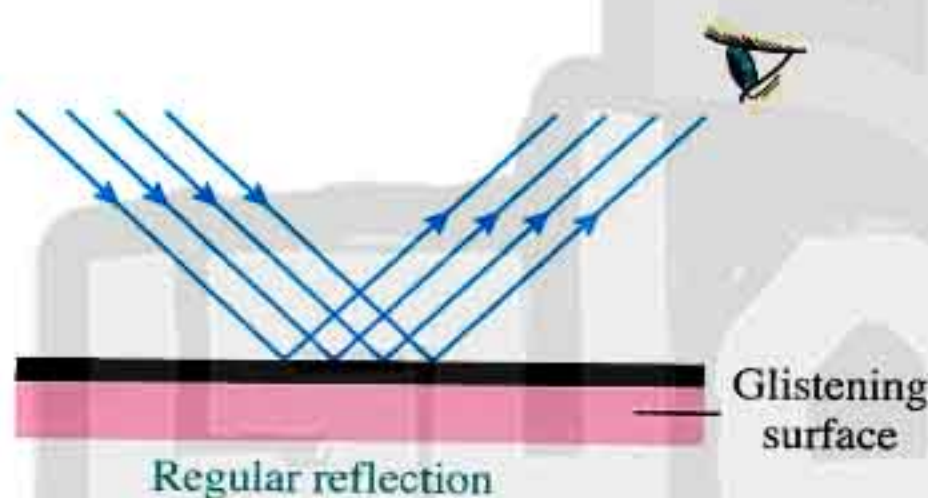


**Types of light reflection :**

Light reflection is classified according to the nature of the reflecting surface into :

**1 Regular (uniform) reflection****Regular (uniform) reflection :**

It is the reflection of light rays when they meet (fall on) a smooth (uniform) and glistening reflecting surface, where the incident light rays are reflected in one direction.

**Examples of smooth surface :**

- A plane mirror.



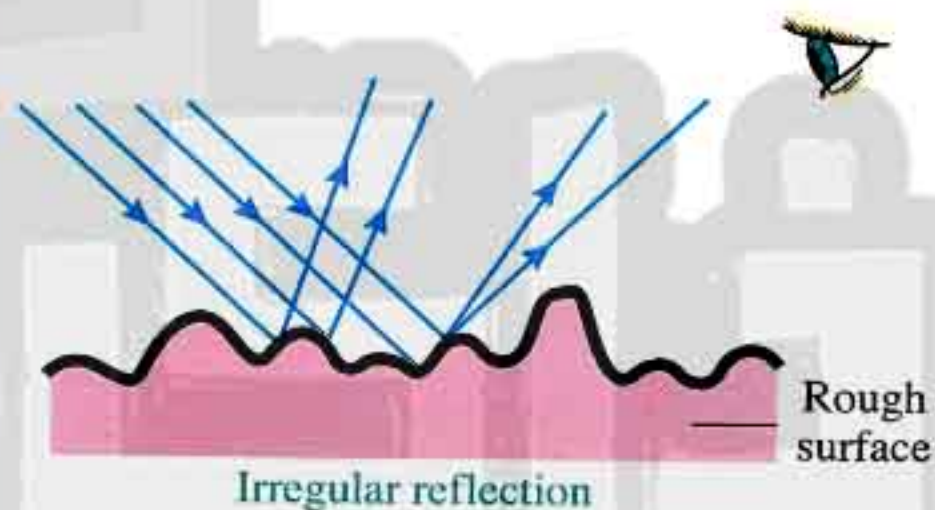
- A thin sheet of aluminium (foil).



- A stainless steel sheet.

**2 Irregular (non-uniform) reflection****Irregular (non-uniform) reflection:**

It is the reflection of light rays when they meet (fall on) a rough (non-uniform) reflecting surface, where the incident light rays are reflected in different directions.

**Examples of rough surface :**

- A leaf of a tree.



- A piece of paper.



- A piece of leather.
- A piece of wool.



UNIT  
2**? Exercise** Answer the following question :

Mention the type of reflection when light rays fall on :

1. A woolen jacket.

2. A stainless steel sheet.

**✓ Answer**

1. Irregular reflection.

2. Regular reflection.

**► Enrichment information**

The surface of a clean mirror causes regular reflection, while the dirty mirror surface causes irregular reflection.

**Laws of light reflection :**

➔ To know the laws of light reflection, we should know some basic concepts that are used in this laws.

**Angle of incidence :**

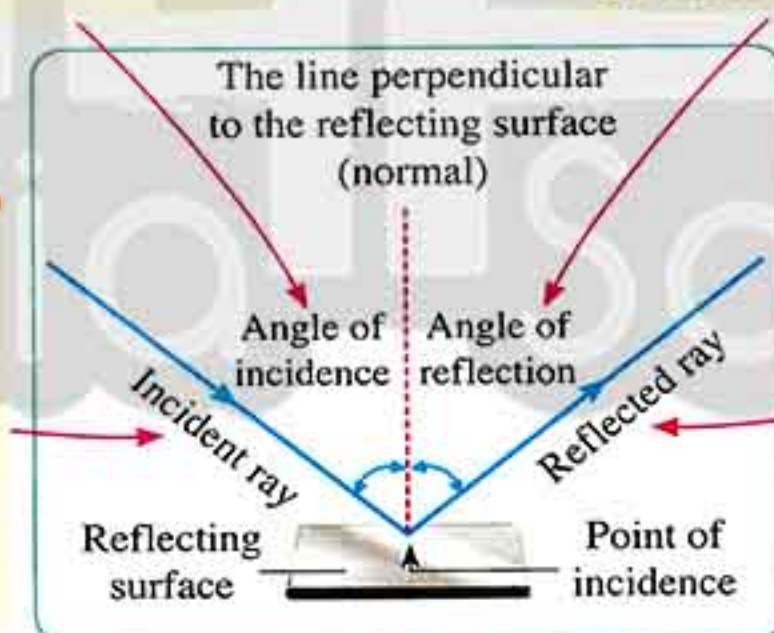
It is the angle between the incident light ray and the line perpendicular to the reflecting surface at the point of incidence.

**Angle of reflection :**

It is the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence.

**The incident light ray :**

It is a narrow light beam which is represented by a straight line, it intersects with the reflecting surface at the point of incidence.

**The reflected light ray :**

It is a narrow light beam which is represented by a straight line, it is reflected from the reflecting surface at the point of incidence.

**? What is meant by ?**

**The angle of reflection of a light ray =  $40^\circ$**

➔ This means that the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence equals  $40^\circ$ .

**The angle of incidence of a light ray =  $30^\circ$**

➔ This means that the angle between the incident light ray and the line perpendicular to the reflecting surface at the point of incidence equals  $30^\circ$ .



## Lesson Three

When light reflects on a surface, its reflection is ruled by two important laws.



## ACTIVITY 1

To conclude the two laws of light reflection :



## Warning

Avoid exposing the eyes to direct laser.

**Materials and tools :**

- Plane mirror.
- Protractor.
- Laser pen.
- White paper.

| Steps   | Figure | Observations  |
|---|--------|---|
| <ol style="list-style-type: none"> <li>Fix a plane mirror horizontally and fix on its edge, a white paper and a plastic protractor perpendicular to it.</li> <li>Direct a light ray on the plane mirror surface tangent to the paper (as shown in the figure).</li> <li>Measure the angle of incidence and the angle of reflection.</li> <li>Change the angle of incidence several times and measure the angle of reflection in each time.</li> </ol> |        | <ol style="list-style-type: none"> <li>The angle of incidence = the angle of reflection.</li> <li>The angle of reflection changes according to the change of the angle of incidence, since they are equal.</li> </ol> |

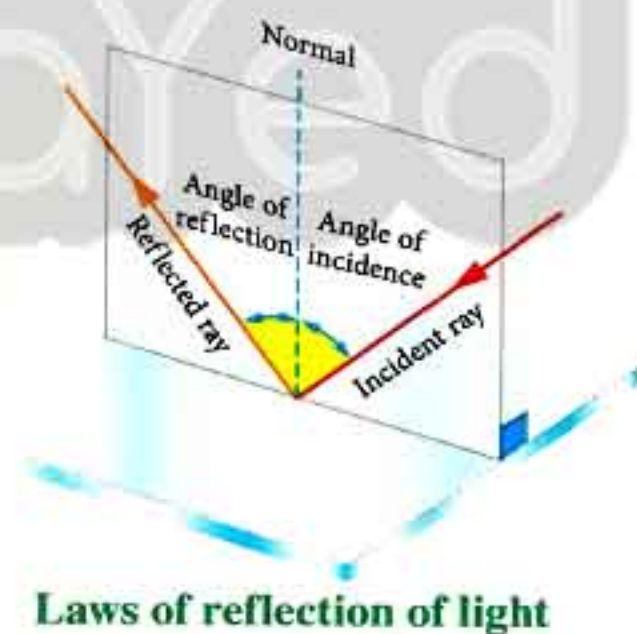


## Conclusion :

The reflection of light is governed by two laws :

**First law** : Angle of incidence = Angle of reflection

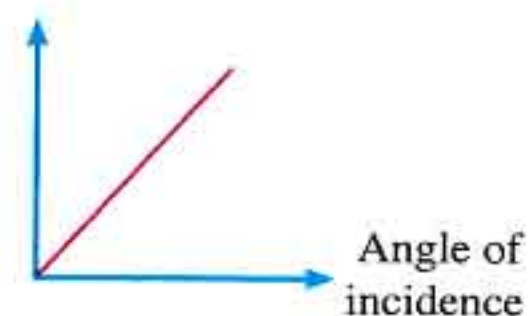
**Second law** : The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all locate in one plane perpendicular to the reflecting surface.



NB

The opposite graph represents the relation between the angle of incidence and the angle of reflection.

Angle of reflection





UNIT  
2

## ► Enrichment information

The distance between the Earth and the Moon can be measured by the reflection of a laser beam directed from the Earth towards a reflecting surface placed on the Moon surface.

TRY

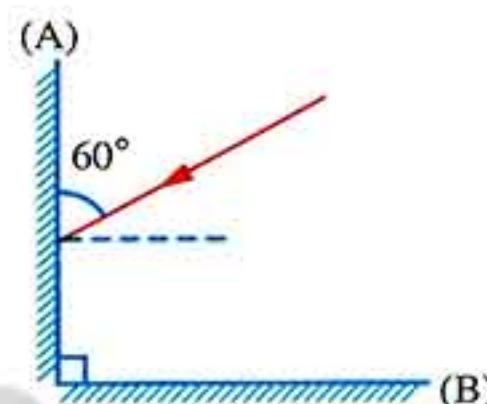
TO ANSWER worksheet  
in the Notebook

12

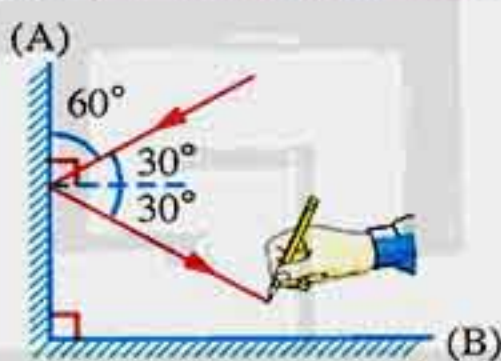
## ? Example 1

In the opposite figure, a light ray falls on mirror (A), complete the path of the ray till it refracts from mirror (B), then calculate the value of :

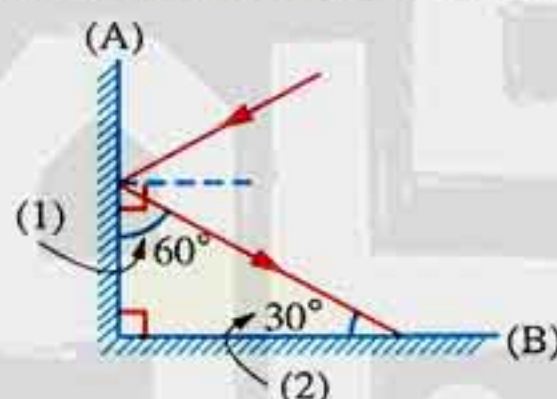
- (1) The reflecting angle from mirror (A).
- (2) The incidence angle on mirror (B).



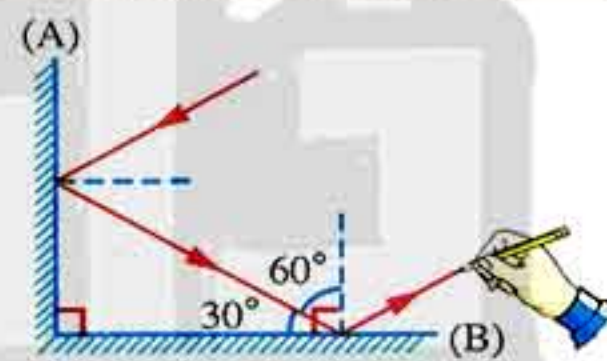
## Idea of Solution



Reflecting angle from mirror (A) = incidence angle  
 $= 90^\circ - 60^\circ = 30^\circ$



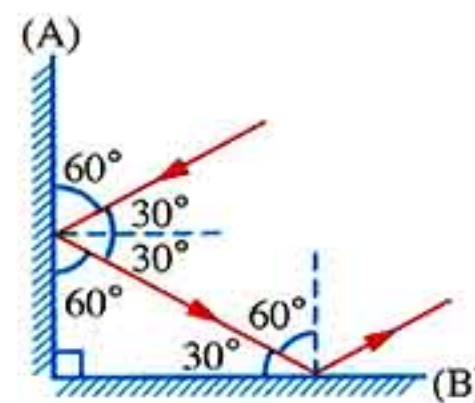
The angle (1) between reflecting ray and mirror (A)  
 $= 90^\circ - 30^\circ = 60^\circ$   
 $\therefore$  The sum of angle of triangle  $= 180^\circ$   
 $\therefore$  The angle (2) between incident ray and mirror (B)  
 $= 180^\circ - (60^\circ + 90^\circ) = 30^\circ$



$\therefore$  The incidence angle on mirror (B)  
 $= 90^\circ - 30^\circ = 60^\circ$

## ✓ Solution

- (1) The reflecting angle from mirror (A)  $= 30^\circ$
- (2) The incidence angle on mirror (B)  $= 60^\circ$



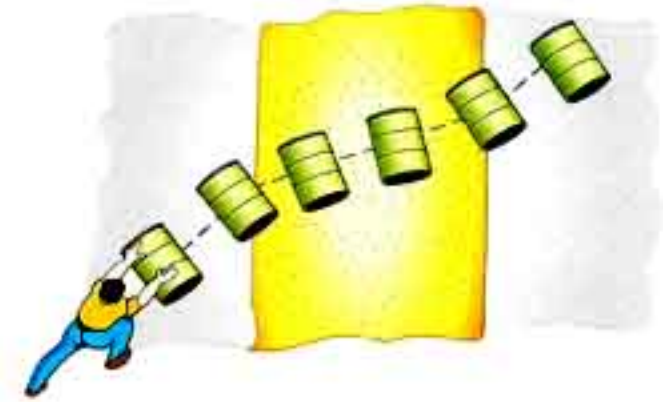


## Lesson Three

2

**Light refraction :**

When you push a barrel from asphalt to sand then to asphalt again, the barrel changes its path (as shown in the figure). This is due to the change of barrel velocity on asphalt from that on sand.



**Similarly,** as light travels from :

a transparent medium  
(like air)



another transparent  
medium (like glass)

Its path changes due to the difference of the velocity of light through different transparent media and this phenomenon is known as "Light refraction".



Refraction of light

**Light refraction :**

It is the change of light path when it travels from a transparent medium to another transparent medium of different optical density.

The ability of the transparent medium to refract the light is called the "optical density of the medium".

**Optical density of the medium:**

It is the ability of the transparent medium to refract light.

**Each medium** has its own optical density,

**So** the optical density of a medium differs from one medium to another

**Which leads to** the change in the light velocity through such medium.

**i.e.** As optical density of the medium increases the speed of light through it decreases and vice versa.

**GR.**

**The velocity of light changes from one medium to another.**

Because the optical density of a medium differs from one medium to another.

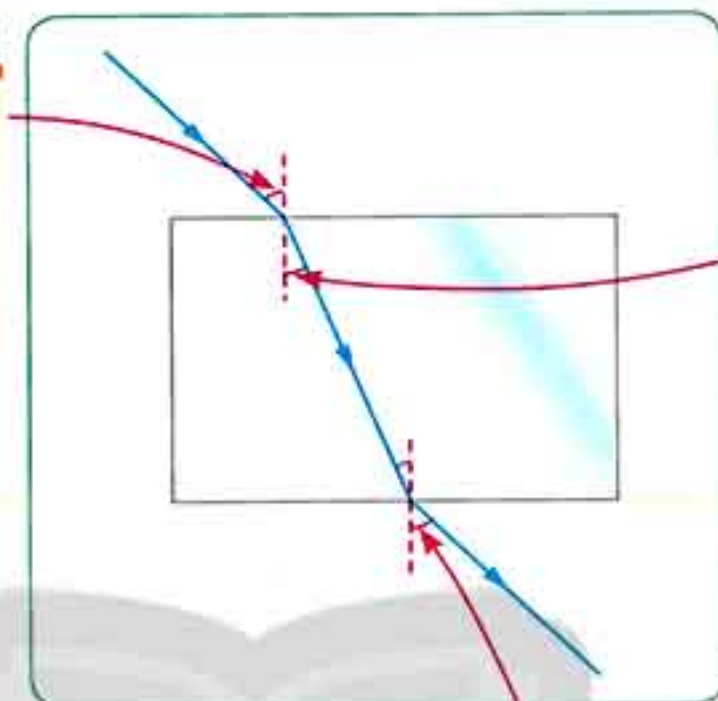


UNIT  
2

## Concepts related to light refraction :

**The angle of incidence :**

It is the angle between the incident light ray and the normal at the point of incidence on the interface.

**The angle of refraction :**

It is the angle between the refracted light ray and the normal at the point of incidence on the interface.

**The angle of emergence :**

It is the angle between the emergent light ray and the normal at the point of emergence on the interface.

**What is meant by ... ?**

The angle of emergence in a prism is  $50^\circ$  ?

➤ This means that the angle between the emergent ray and the line perpendicular to the interface at the point of emergence is  $50^\circ$

**ACTIVITY**

2

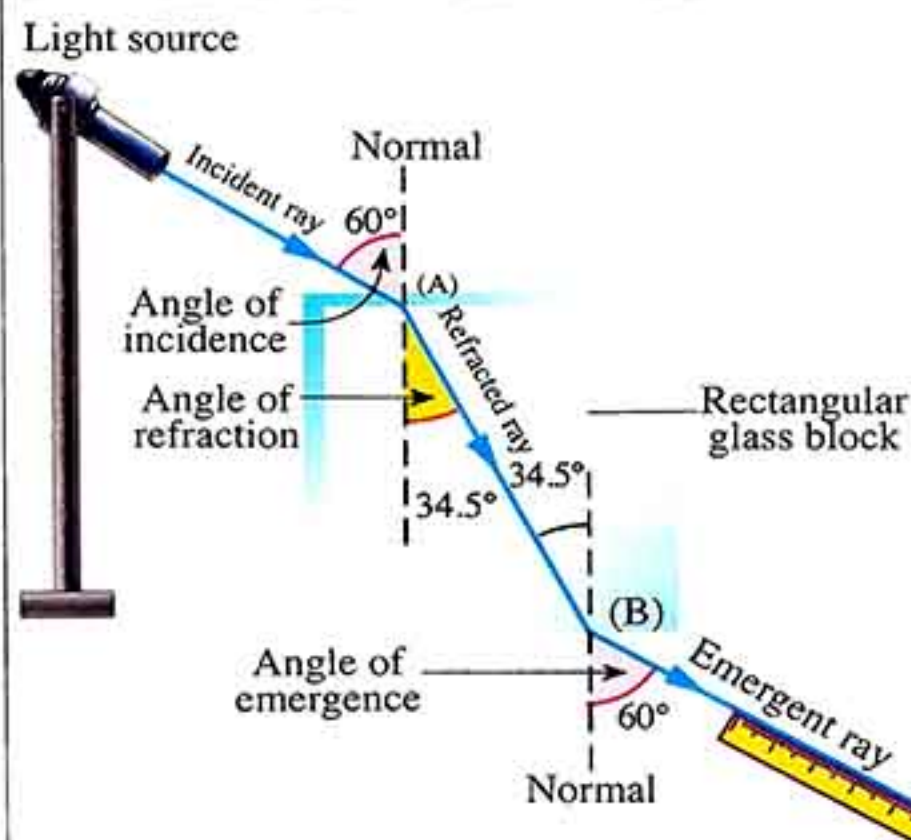
To demonstrate the light refraction :

**Materials and tools :**

- Thick rectangular glass block.
- White paper sheet.
- Pencil.
- Ruler.
- Protractor.
- Laser pen.

**Steps**

1. Put a rectangular glass block on a white paper sheet and mark around the block using a pencil.
2. Direct a ray from the laser pen to the point of incidence (A) on the side of the rectangular glass and draw its path (using the pencil and the ruler) to represent the incident ray.
3. Draw the path of the emergent ray from point (B) on the opposite side of the glass.
4. Remove the rectangular glass and join the two points (A) and (B) with a straight line which represents the refracted ray.
5. Draw at (A) and (B) dotted vertical lines, where it represents the normal at the point of incidence and at the point of emergence on the interface.

**Figure**



**Observations :**

- When the light ray travels from air into glass or vice versa, it refracts.
- The angle of incidence ( $60^\circ$ ) is not equal to the angle of refraction ( $34.5^\circ$ ).
- The angle of incidence ( $60^\circ$ ) is equal to the angle of emergence ( $60^\circ$ ).
- The incident light ray is parallel to the emergent light ray.

**Conclusion :**

The light refraction phenomenon occurs when the light ray travels from a transparent medium to another transparent medium of different optical density.

**Laws of light refraction :**

The path of a light ray falls on the interface between two transparent media differ in their optical densities :

1. When a light ray travels from a transparent medium of lower optical density (like air or water) to another of higher optical density (like glass).

refracts near the normal.

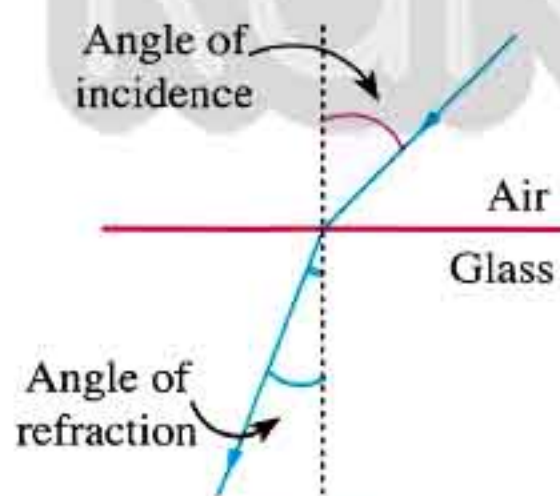


Fig. (1)

The angle of incidence **is greater than** the angle of refraction.

2. When a light ray travels from a transparent medium of higher optical density (like glass) to another of lower optical density (like air or water).

refracts far from the normal

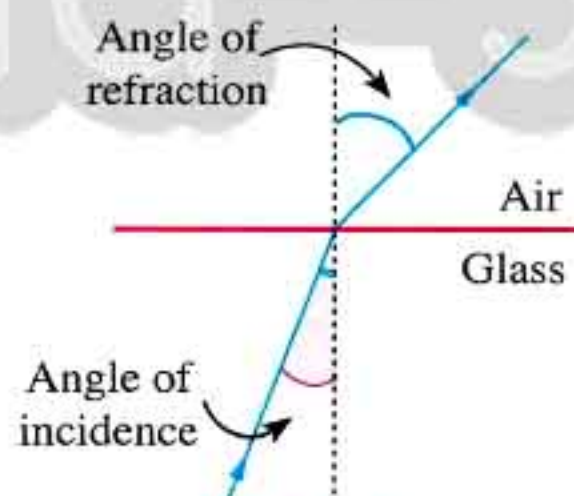


Fig. (2)

The angle of incidence **is smaller than** the angle of refraction.

3. When a light ray falls perpendicular to the interface between two different transparent media.

passes without refraction

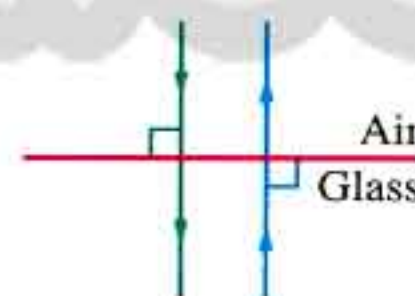


Fig. (3)

The angle of incidence **is equal to** the angle of refraction equals zero



UNIT  
2

➔ From the previous facts we conclude that, the two factors necessary for occurrence of light refraction are :

1. The presence of an interface in between two different transparent media which differ in their optical densities.
2. The incident light ray falls inclined to the interface (angle of incidence  $\neq$  zero)

So, we can observe that the amount of refraction due to the transfer of a light ray from a medium to another depends on the optical density of each medium.

and, there is a relation between the velocity of light through air and any other transparent medium, which is known as "Absolute refractive index".

### Absolute refractive index of a medium :

It is the ratio between the velocity of light through air to the velocity of light through another transparent medium.

Absolute refractive index of a medium

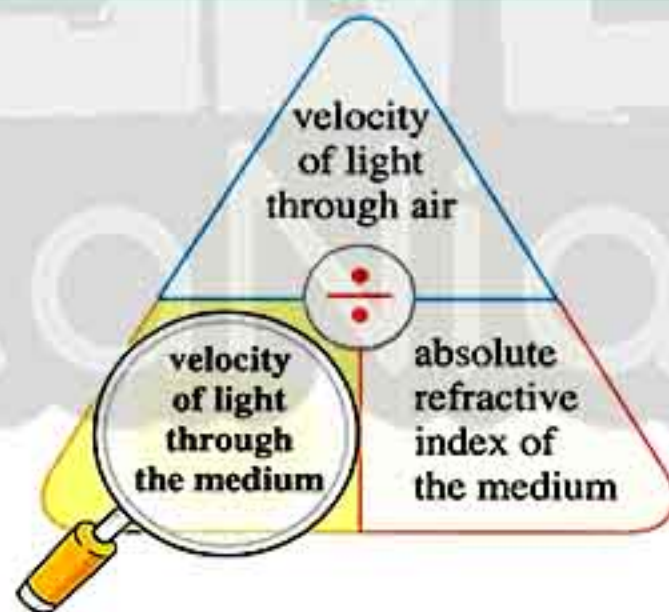
=

$\frac{\text{Velocity of light through air}}{\text{Velocity of light through the medium}}$

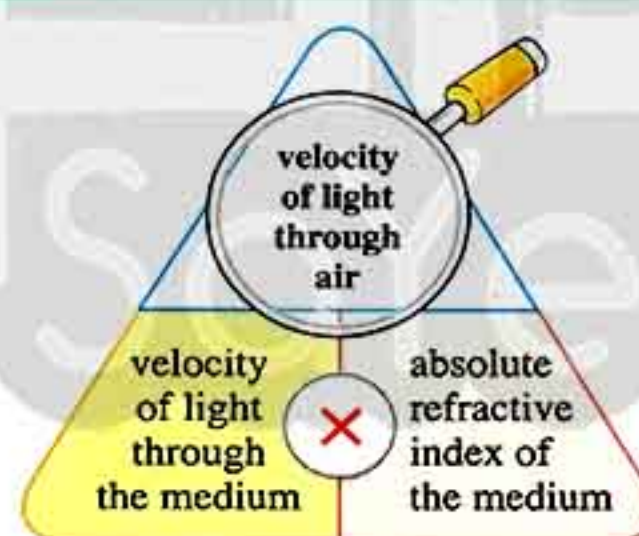


To calculate :

The velocity of light through the medium



The velocity of light through air



If the refractive index of a medium is high



Its optical density is high



The speed of light through it decreases



Its ability to refract light increases (where the refracted light ray is near the normal)

**GR.**

**The absolute refractive index of any transparent medium is always greater than one .**

Because the velocity of light through air is always greater than that through any other transparent medium.



## ? What is meant by ?

**The absolute refractive index of glass is 1.5 ?**

➔ This means that the ratio of velocity of light through air to that through glass is 1.5

### ► Enrichment information

The ratio between the absolute refractive index of a medium to the absolute refractive index of another medium is known as the **relative refractive index**.

## Problems

- 1** Calculate the velocity of light through glass given that the velocity of light through air equals  $3 \times 10^8$  m/s and the absolute refractive index of glass is 1.5

### Solution

$$\text{The absolute refractive index of glass} = \frac{\text{Velocity of light through air}}{\text{Velocity of light through glass}}$$

$$\text{The velocity of light through glass} = \frac{3 \times 10^8}{1.5} = 2 \times 10^8 \text{ m/s.}$$

- 2** If the velocity of light through water is  $2.25 \times 10^8$  m/s, calculate the absolute refractive index of water. Knowing that the velocity of light through air is  $3 \times 10^8$  m/s.

### Solution

$$\text{The absolute refractive index of water} = \frac{\text{Velocity of light through air}}{\text{Velocity of light through water}}$$

$$= \frac{3 \times 10^8}{2.25 \times 10^8} = \frac{3}{2.25} = 1.33$$

## Notes

- Glass, water and air are examples of transparent media, which are different in optical density and they are arranged according to the optical density as follows :

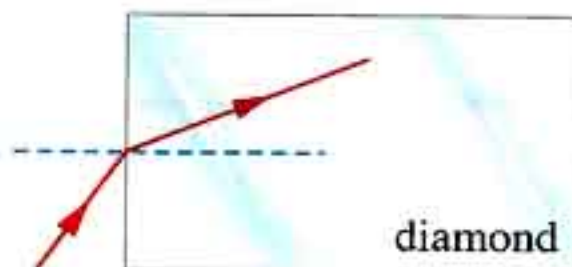
**Glass > water > air**

- The medium, which has large optical density, has large absolute refractive index and then the velocity of light pass through it, will be small.

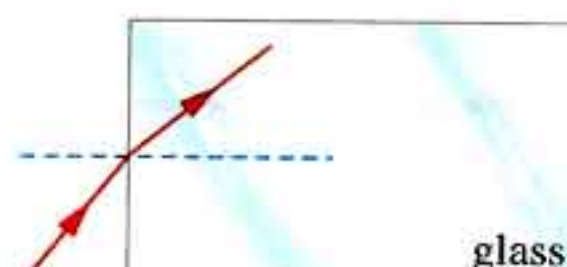
**GR.**

**The ability of diamonds to refract the light is greater than that of glass .**

Because the absolute refractive index of the diamond is greater than the absolute refractive index of the glass.



diamond



glass



UNIT  
2

## Natural phenomena related to reflection and refraction of light :

## 1 Apparent shapes of objects :

A pencil, which is partially immersed in water appears as being broken (as shown in the figure). **GR.**

Due to the refraction of light rays coming from the immersed part in water.

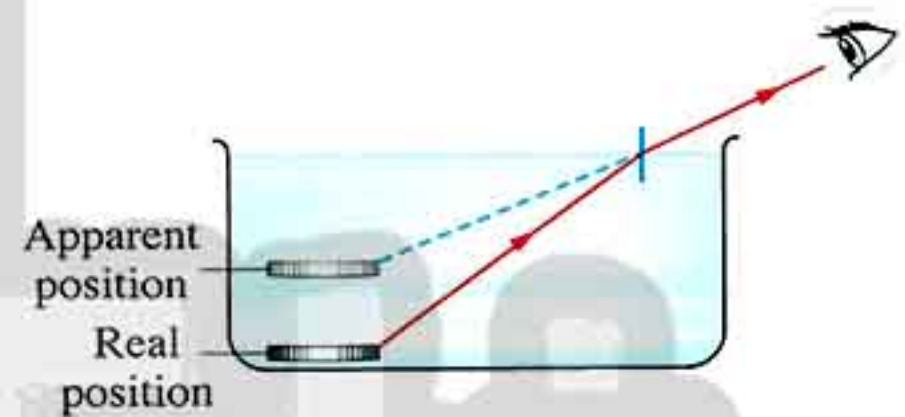


Pencil image due to light refraction

## 2 Apparent positions of objects :

The submerged object in water is seen in an **apparent position** slightly above its **real position** (as the coin shown in the figure). **GR.**

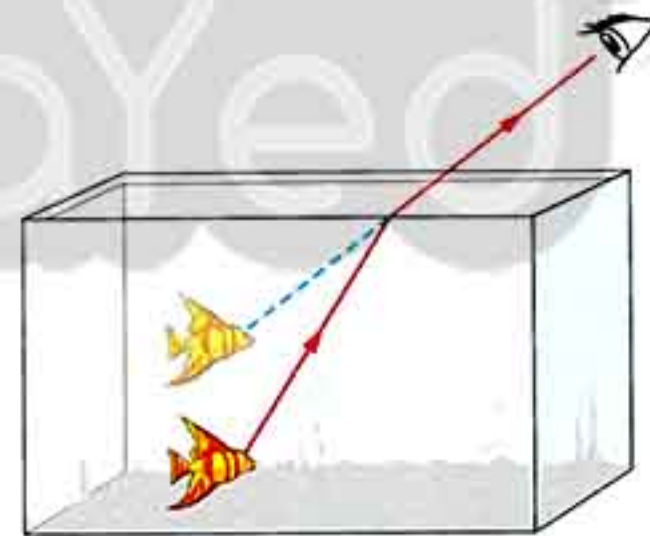
Due to the refraction of light rays coming from the submerged object (far from the normal) where, the eye sees this object in an apparent position on the extensions of these refracted rays.



**GR.**

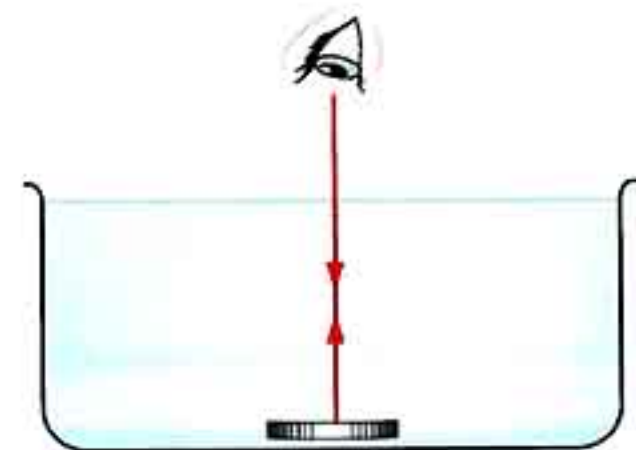
- The fish that is put in a glass basin seems at a position higher than its real position.

Due to the refraction of light rays coming from the object where the eye sees the fish in an apparent position on the extension of these refracted rays.



- To pick up a coin which has fallen in water, we must look at it vertically.

Because the incident light ray perpendicular to the interface between air and water, passes without refraction, so the apparent position is the real position.





## Lesson Three

3

## Mirage :

## Mirage :

It is a natural phenomenon that takes place on the desert roads at noon especially in the summer times, where objects on the road sides seem as if they have inverted images on a wet area.



Mirage phenomenon

Mirage phenomenon occurs due to refraction and reflection of light in air layers which differ in the degree of temperature.

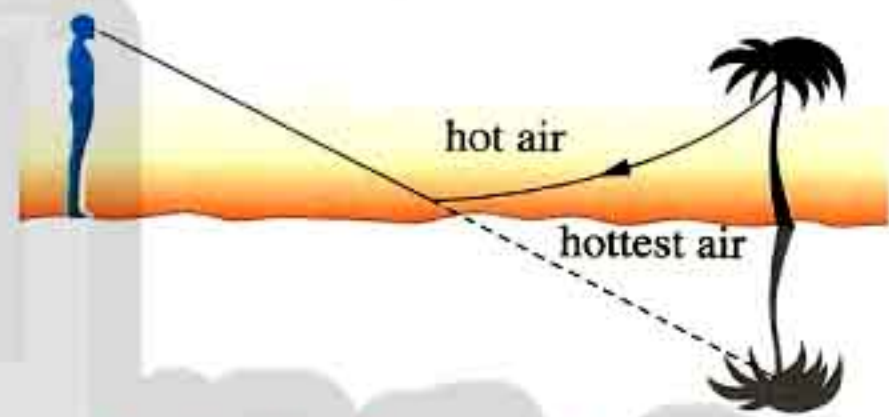


Illustration of mirage phenomenon

## ► Enrichment information

A group of refractions and reflections of the sun rays occurs when the Sun ray is incident on water drops or snow crystals suspended in air leading to analyze the light into a bow of spectrum colours known as *rainbow*.



Rainbow

## TRY

## TO ANSWER worksheet

13

- General Exercise of the School Book on Unit 2
- Model exams on Unit 2 in the Notebook





# Remember

## ★ Light reflection :

It is the rebounding (returning back) of light waves in the same medium on meeting a reflecting surface.

### Types of light reflection according to the nature of reflecting surface

#### ① Regular (uniform) reflection

#### ② Irregular (non-uniform) reflection

## ★ Regular (uniform) reflection :

It is the reflection of light rays when they meet (fall on) a smooth (uniform) and glistening reflecting surface, where the incident light rays are reflected in one direction.

## ★ Irregular (non-uniform) reflection :

It is the reflection of light rays when they meet (fall on) a rough (non-uniform) reflecting surface, where the incident light rays are reflected in different directions.

## ★ The incident light ray :

It is a narrow light beam, which is represented by a straight line, it intersects with the reflecting surface at the point of incidence.

## ★ The reflected light ray :

It is a narrow light beam which is represented by a straight line that is reflected from the reflecting surface at the point of incidence.

## ★ Angle of incidence :

It is the angle between the incident light ray and the line perpendicular to the reflecting surface at the point of incidence.

## ★ Angle of reflection :

It is the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence.

## ★ Laws of light reflection :

**First law :** Angle of incidence = Angle of reflection

**Second law :** The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all lie in one plane perpendicular to the reflecting surface.



★ **Light refraction :**

It is the change of light path when it travels from a transparent medium to another transparent medium of different optical density.

★ **Optical density of the medium :**

It is the ability of the transparent medium to refract the light.

**Concepts related to light refraction :**★ **The angle of incidence :**

It is the angle between the incident light ray and the normal to the surface at the point of incidence on the interface.

★ **The angle of refraction :**

It is the angle between the refracted light ray and the normal to the surface at the point of incidence on the interface.

★ **The angle of emergence :**

It is the angle between the emergent light ray and the normal to the surface at the point of emergence on the interface.

★ **Absolute refractive index of a medium :**

It is the ratio between the velocity of light through air to the velocity of light through another transparent medium.

$$\text{Absolute refractive index of a medium} = \frac{\text{Velocity of light through air}}{\text{Velocity of light through the medium}}$$


★ **Natural phenomena related to reflection and refraction of light :**

1. Apparent shapes of objects.
2. Apparent positions of objects.
3. Mirage.



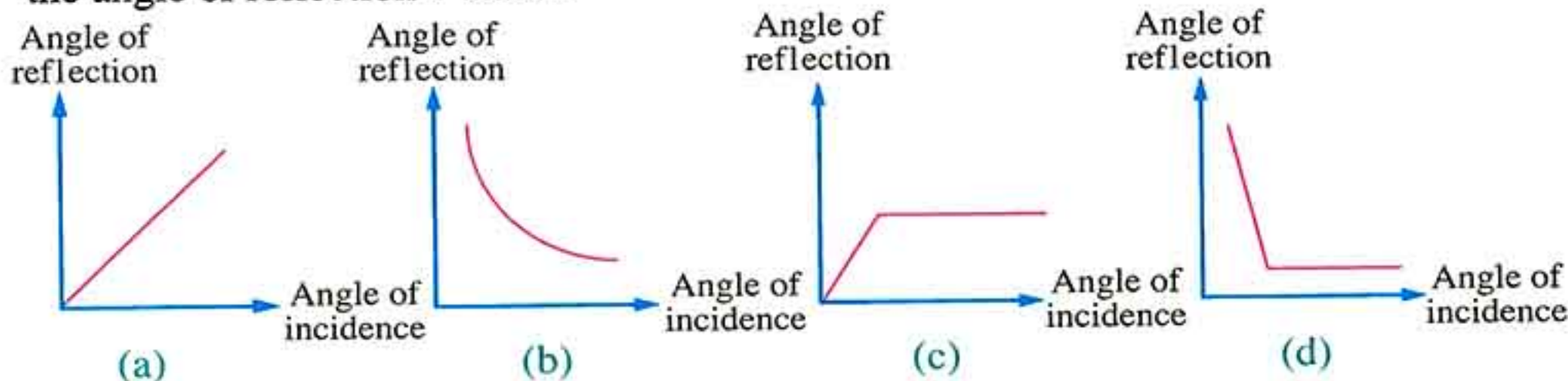
# Questions

## on lesson three

Questions signed by  have been taken from the school book.

### 1. Choose the correct answer :

- Light ..... plays an important role in the formation of inverted images of the objects on the road when rain falls.  
a. velocity      b. refraction      c. reflection      d. frequency
- In ..... reflection, the reflected rays are reflected in many directions.  
a. irregular      b. uniform      c. regular      d. total internal
- A regular reflection happens when light rays fall on .....  
a. a woolen jacket.      b. a stainless steel sheet.  
c. a leaf of a tree.      d. a piece of leather.
- Light is reflected ..... when it falls on a smooth bright surface.  
a. regularly      b. irregularly      c. and refracted      d. and scattered
- Light is reflected ..... when it falls on a rough surface.  
a. regularly      b. irregularly      c. and refracted      d. in one direction
- The angle between the reflected ray and the line perpendicular to the reflecting surface at the point of incidence is called the angle of .....  
a. emergence.      b. incidence.      c. refraction.      d. reflection.
- If the angle between the incident light ray and the reflected light ray is  $90^\circ$ , so the angle of incidence equals .....  
a.  $0^\circ$       b.  $30^\circ$       c.  $45^\circ$       d.  $90^\circ$
- If the angle between a reflected light ray and a reflecting surface is  $30^\circ$ , so the angle of reflection will be equal to .....  
a.  $15^\circ$       b.  $30^\circ$       c.  $60^\circ$       d.  $90^\circ$
- If you know that the incident ray which falls perpendicular on a reflecting surface reflects on itself, so the angle of reflection is equal to .....  
a.  $0^\circ$       b.  $90^\circ$       c.  $120^\circ$       d.  $180^\circ$
- The angle of incidence of light is ..... its angle of reflection.  
a. larger than      b. smaller than      c. equal to      d. no correct answers
- Which of the following graphs represents the relation between the angle of incidence and the angle of reflection ? .....



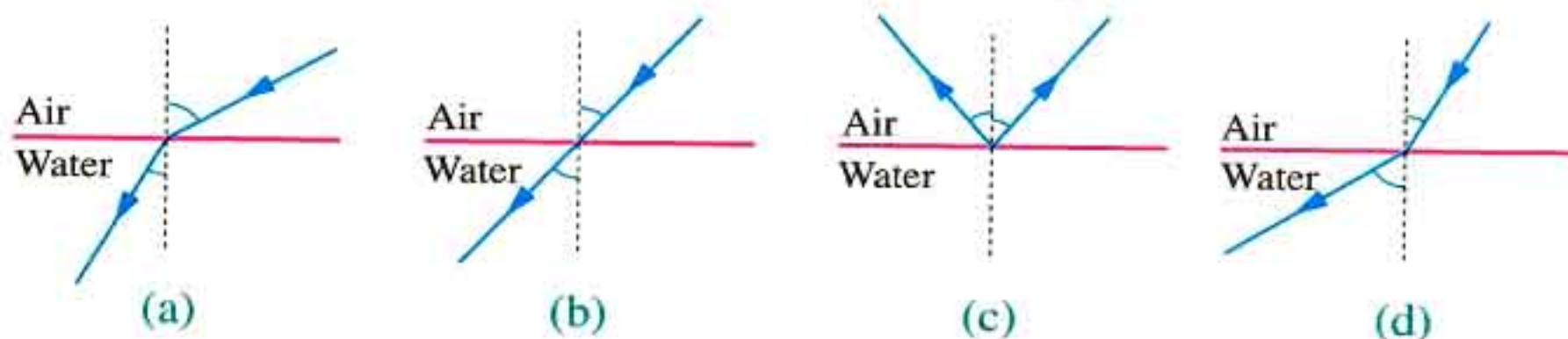


## Lesson three

12. The ability of the transparent medium to refract the light is called the ..... of the medium.  
 a. refractive index      b. density      c. optical density      d. viscousity
13. The ..... is the change in the direction of light rays when light passes from a transparent medium to another transparent medium of different optical density.  
 a. light reflection      b. light refraction  
 c. light absorption      d. light separation
14. The angle between the refracted light ray and the normal at the point of incidence on the separating surface is .....  
 a. the angle of reflection.      b. the angle of refraction.  
 c. the angle of incidence.      d. no correct answer.
15. The angle between the emergent light ray and the normal at the point of emergence on the interface is called the angle of .....  
 a. incidence.      b. reflection.      c. refraction.      d. emergence.
16. Light refraction is due to the difference in ..... through different media.  
 a. sound intensity      b. nature of the surface  
 c. light velocity      d. all the previous answers
17. Which of the following figures represents the refraction of light in a rectangular glass block? Give a reason.



18. The angle of incidence is greater than the angle of refraction when a light ray travels from .....  
 a. air to water.      b. air to glass.  
 c. water to air.      d. (a) and (b) are correct.
19. When light ray travels from air to water, it .....  
 a. refracts near the normal.      b. refracts far from the normal.  
 c. passes without refraction.      d. reflects.
20. Which of the following figures represents a correct light refraction? .....



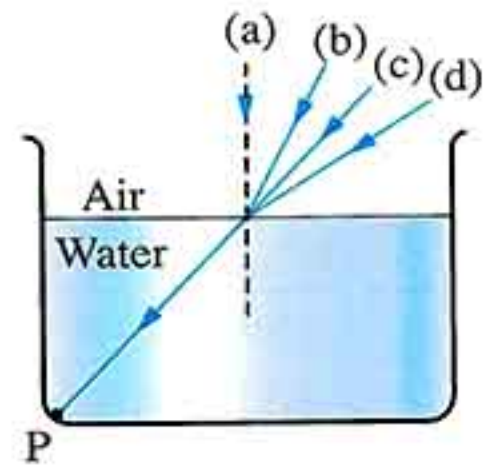


UNIT  
2

21. In which direction should a spotlight be directed to the water surface to be inspected at point (p) ?

- a. (a)  
c. (c)

- b. (b)  
d. (d)



22. The absolute refractive index of any material is always .....

- a. more than one.      b. less than one.      c. equal to one.      d. equal zero.

23. We have got the refractive index of four materials. Which result of the four is incorrect ? ..... (Give a reason)

- a. 0.8      b. 1.3      c. 1.5      d. 1.8

24. The absolute refractive index is the ratio between the speed of light through air and .....

- a. the speed of light through another medium.  
b. the speed of light through the same medium.  
c. the speed of sound through the same medium.  
d. no correct answer.

25. A pencil seems broken when it is placed in a glass cup of water due to the ..... of light.

- a. reflection      b. refraction  
c. total internal reflection      d. no correct answer

26. When a boy looked at a fish under water, it seemed to be in the shown position. Which position is the real one ? .....

- a. A , B      b. D  
c. E      d. C , E



27. From the natural phenomena that is resulted from the refraction and reflection of light on the desert roads is .....

- a. echo.      b. mirage.  
c. seeing objects higher than its normal position.  
d. no correct answer.



## 2. Choose from column (B) what suits it in column (A) :

| 1.                        | (A) | (B)  |
|---------------------------|-----|--|
| 1. Angle of incidence is  |     | a. the change of the path of light ray when it moves between two media with different optical densities. |
| 2. Angle of reflection is |     | b. the angle between the extensions of both, the incident ray and the emergent ray.                      |
| 3. Angle of refraction is |     | c. the angle between the incident light ray and the normal to the surface.                               |
| 4. Light reflection is    |     | d. the change in the direction of light ray in the same medium, when it falls on a reflecting surface.   |
| 5. Light refraction is    |     | e. the angle between the reflected light ray and the normal to the surface.                              |
|                           |     | f. the angle between the refracted light ray and the normal to the surface.                              |

| 2.  | (A) | (B)  |
|---|-----|--|
| 1. The incident light ray that is perpendicular to the separating surface between two different transparent media |     | a. higher than their real positions.             |
| 2. The incident light ray on a surface of plane mirror  |     | b. it reflects on itself.                        |
| 3. Fish that swim in water are seen   |     | c. it refracts.                                  |
| 4. A light ray passes inclined from a transparent medium to another transparent medium                            |     | d. does not refract (passes in a straight line). |


## 3. Put (✓) or (×) , then correct what is wrong :

- Light refraction is the rebounding of light rays in the same medium on meeting a reflecting surface. ( )
- Light reflection plays an important role in the formation of inverted images of trees on the road when rain falls. ( )
- In uniform reflection, the light rays are reflected directly in one direction. ( )
- Reflection of light from rough surfaces is called regular reflection. ( )
- The reflection of light on a piece of white paper is a regular reflection, while the reflection of light in a plane mirror is an irregular reflection. ( )
- The angle of reflection of a light ray falls perpendicular on a reflecting surface equals  $90^\circ$  ( )



7. Light reflects when it travels from a transparent medium to another one of different optical density. ( )
8. The ability of the transparent medium to refract light is called the refractive index of the medium. ( )
9. The optical density of a medium differs from one medium to another due to the change in the light intensity through such medium. ( )
10. The light ray refracts near to the normal when it travels from air to glass. ( )
11. When light ray travels from air to water, the angle of incidence is greater than the angle of refraction. ( )
12. The optical density of the medium is the ratio between the velocity of light through air to the velocity of light through the medium. ( )
13. The reason for light refraction is that its velocity is equal in the different transparent media. ( )
14. The absolute refractive index of any transparent medium is always greater than one. ( )
15. The velocity of light through any transparent medium is less than that through air. ( )
16. The fish is seen higher than its real position in the fish tank. ( )
17. Objects on the desert road sides seem as if they had inverted images on a wet area due to the mirage phenomenon. ( )

#### 4. Write the scientific term of each of the following statements :

1. The rebounding (returning) of light waves in the same medium on meeting a reflecting surface.
2. A smooth or rough surface, at which the reflection of light takes place.
3.  The reflection in which the light rays recoil in one direction, when falling on a glistening surface.
4. The reflection in which the light rays recoil in many directions, when falling on a rough surface.
5. A narrow light beam, which is represented by a straight line that is reflected from the reflecting surface at the point of incidence.
6. The angle between the incident light ray and the normal at the point of incidence on the separating surface.
7. The angle between the reflected light ray and the normal at the point of incidence on the reflecting surface.
8. Angle of incidence = angle of reflection.
9. The incident light ray, the reflected light ray and the normal on the surface of reflection at the point of incidence, all locate in one plane perpendicular to the reflecting surface.



10. The ability of the medium to refract light rays.
11. Changing the path of light when it travels from a transparent medium to another transparent medium of different optical density.
12. The angle between the refracted light ray and the normal at the point of incidence on the separating surface.
13. The angle between the emergent light ray and the normal at the point of emergence on the interface.
14. The ratio between the velocity of light through air to the velocity of light through another transparent medium.
15. The position, at which the submerged object in water is seen slightly above its real position.
16. The phenomenon that appears in the desert as a result of refraction and reflection of light on the desert roads.

### 5. Complete the following statements :

1. The light reflection is classified into two types which are ..... and .....
2. In ..... reflection, the reflected rays are in one direction, while in ..... reflection, the reflected rays are in different directions.
3. When parallel light rays meet a rough surface, they reflect in ..... directions and this is called ..... reflection.
4. The ..... and the thin aluminium sheet are examples of smooth surfaces which cause ..... reflection.
5. A woolen jacket causes ..... reflection of light rays, while a stainless steel sheet causes ..... reflection of light rays.
6. The angle of ..... is the angle between the incident ray and the line perpendicular to the reflecting surface at the point of .....
7. The first law of light reflection states that .....
8. The incident light ray, the ..... light ray and the normal to the surface of reflection at the point of incidence, all locate in one plane ..... to the ..... surface.
9. When a light ray falls on a reflecting surface, the angle between the incident ray and the reflecting surface is  $35^\circ$ , therefore the angle of reflection equals ..... and the angle between the incident ray and the reflected ray equals .....
10. When a light ray falls perpendicular on a reflecting surface, it reflects ....., because the angle of incidence and the angle of reflection equal .....
11. The optical density of a medium differs from one medium to another due to the change in the ..... through such medium.
12. Light ..... is the change of light path when it travels from a transparent medium to another transparent medium of different .....
13. The angle of ..... is the angle between the refracted light ray and the ..... at the point of incidence on the separating surface.





## UNIT

## 2

14. When light ray travels from a medium of ..... optical density to another of ..... optical density, it refracts far from the normal on the separating surface.
15. If the angle of incidence is more than the angle of refraction, this means that the light ray travels from a medium of ..... optical density to another of ..... optical density.
16. When light ray travels from water (or glass) to air, the angle of ..... is greater than the angle of .....
17. When light ray travels from air to water, it refracts ..... the normal and the angle of refraction is ..... than the angle of incidence.
18. When light ray falls perpendicular to the interface between two transparent media different in optical densities, it ..... to the other medium without .....
19. The absolute refractive index of the medium is the ratio between ..... to .....
20. As the optical density of a medium is high, so the refractive index of such medium is .....
21. From the natural phenomena that are related to the reflection and refraction of light are ..... , ..... and .....
22. A pencil which is partially immersed in water appears as being ..... due to the ..... of light rays coming from the immersed part in water.
23. When we look at a fish in a trough filled with water, its ..... position will be higher than its ..... position. This is due to light .....
24. When you look at a coin in a glass of water, its ..... position appears to be lower than the ..... position.
25. .... is a natural phenomenon that takes place on desert roads at noon in summer days due to light refraction and reflection.

### 6. Give reasons for :

1. The formation of inverted images of the trees and buildings on the road when rain falls.
2. A leather jacket produces irregular light reflection, while a stainless steel plate produces regular light reflection.
3.  The light ray that falls perpendicular on a glistening surface reflects on itself.
4. The velocity of light changes from one medium to another.
5. The light refracts when it travels from a medium to another.
6. When a light ray travels from air to water, it refracts near the normal.
7. When a light ray travels from glass to air, it refracts far from the normal.
8. When a light ray passes through a glass prism, it refracts.
9. The absolute refractive index of any transparent medium is always greater than one.
10.  The ray falling perpendicular on the separating surface between two media different in the optical density doesn't refract.



11. When light ray transfers from a transparent medium to another it may not refracted.
12. The pencil, which is partially immersed in water appears as being broken.
13. The submerged object in water is seen in an apparent position above its real position.
14. The floor of the swimming pool appears higher than its real position.
15. To see a coin which has fallen in a beaker filled with water in its real position, we must look at it vertically.

### 7. Define :

- |  |                                   |
|--|-----------------------------------|
| 1. Light reflection.                           | 2. Reflecting surface.            |
| 3. Regular reflection of light.                | 4. Irregular reflection of light. |
| 5. Angle of incidence.                         | 6. Angle of reflection.           |
| 7. Optical density of a medium.                | 8. Light refraction.              |
| 9. Angle of refraction.                        | 10. Angle of emergence.           |
| 11. The absolute refractive index of a medium. |                                   |
| 12. The refractive index of a medium is high.  |                                   |
| 13. Mirage phenomenon.                         |                                   |

### 8. What is meant by ... ?

1. The angle of reflection of light ray =  $40^\circ$
2. The angle of refraction of light ray =  $20^\circ$
3. The angle of emergence of light ray =  $30^\circ$
4. Absolute refractive index of water is 1.33

### 9. What happens when ... ?

1. Incidence of light rays on a rough surface.
2. Incidence of light rays on a smooth glistening surface.
3. Light ray is incident in a plane mirror by an angle of incidence equals  $30^\circ$
4. Light ray falls perpendicular on a reflecting surface.
5. Light ray travels from a transparent medium to another one of different optical density.
6. Light ray travels from glass to air.
7. Light ray travels from air to glass.
8. Light ray falls perpendicular to the interface between two transparent media of different optical densities.
9. You look at a pencil partially immersed in water.
10. You look at a coin in a glass full of water.



## UNIT

## 2

**10. Show by drawing :**

1. The path of light ray that falls on a reflecting surface with an angle of incidence equals  $30^\circ$
2. The path of light ray falling perpendicular on a reflecting surface.
3. The path of light ray that is incident on one face of a rectangular glass block.
4. The path of light ray which travels from water to air.
5. The path of light ray which travels from a transparent medium of lower optical density (air) to another of high optical density (glass).
6. The path of light ray falling perpendicular to the interface between two transparent media of different optical densities.
7. The path of rays by which Ahmed sees the image of the coin, which is put in a basin containing water (from one side).

**11. Write the physical relation between each of the following :**

1. The light velocity in a medium and the refractive index of its material.
2. The angle of incidence and the angle of reflection of light.


**12. Compare between :**

Regular reflection and irregular reflection.

**13. Explain with drawing an activity to :**

1. Conclude the two laws of light reflection.
2. Demonstrate the light refraction.

**14. Problems :**

1. If the angle between the incident and reflected rays is  $140^\circ$ , find the angle of incidence and the angle of reflection.
2. Calculate the velocity of light through glass if you know that the velocity of light through air is  $3 \times 10^8$  m/sec. and the absolute refractive index of glass is 1.5
3.  Calculate the absolute refractive index of diamond given that the speed of light through it is  $1.25 \times 10^8$  m/s. Knowing that the velocity of light through air is  $3 \times 10^8$  m/sec.
4. If the absolute refractive index of water is  $\frac{4}{3}$  and the velocity of light through water is  $2.25 \times 10^8$  m/s calculate the velocity of light through air.



### 15. Study the following figures, then answer the questions :

(1) Look at the following figures, then complete :

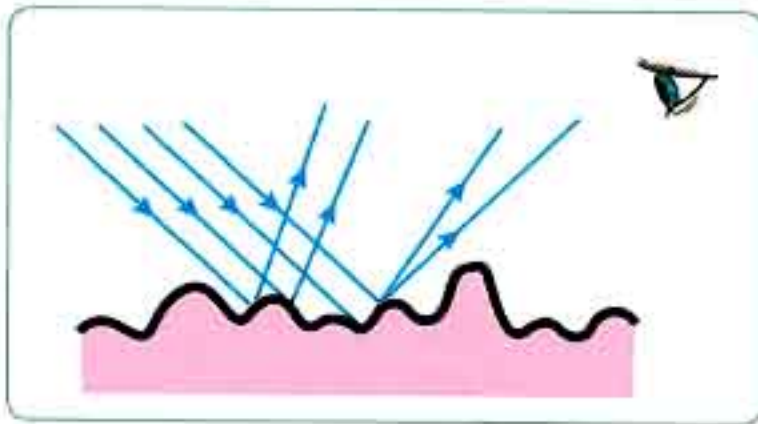


Fig. (a)

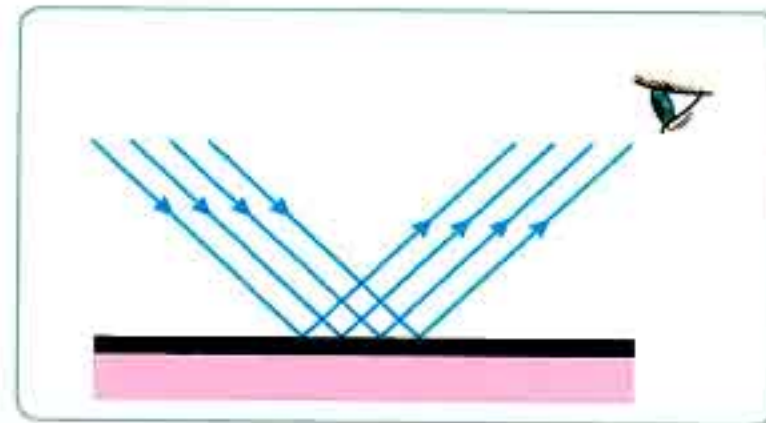
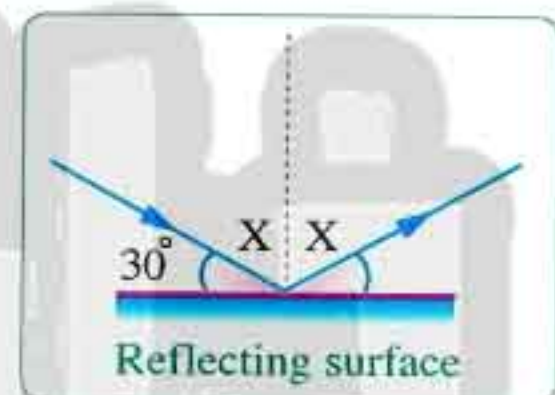


Fig. (b)

1. The two figures represent .....
2. Figure (a) represents ....., so the reflecting surface may be .....
3. Figure (b) represents ....., so the reflecting surface may be .....

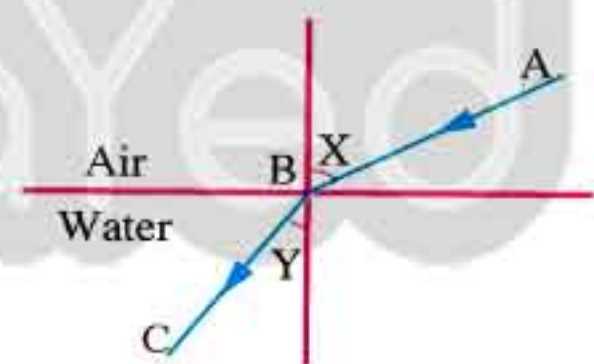
(2) From the opposite figure :

1. Calculate the angle of reflection.
2. Re-draw this figure in your answer paper and show the angle of incidence and the angle of reflection.
3. What can you conclude from this figure ?

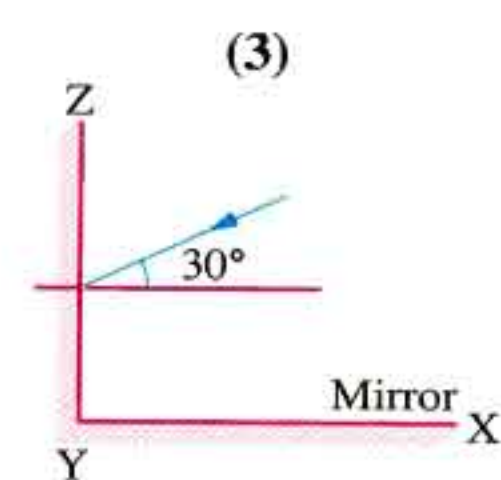
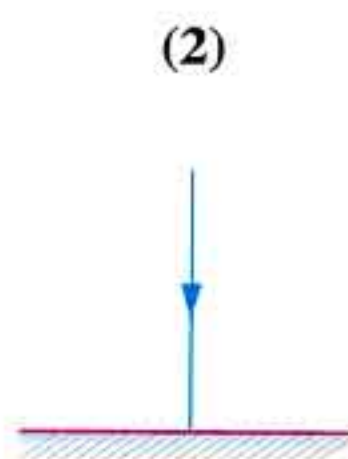
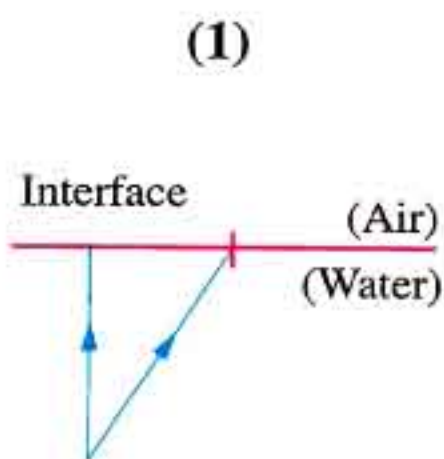


(3) From the opposite figure, complete the following statements :

1. The ray (AB) represents .....
2. The ray (BC) represents .....
3. Angle (X) is .....
4. Angle (Y) is .....



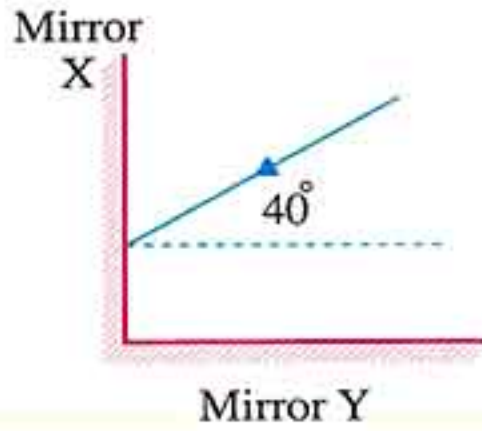
(4) Complete the following figures after redrawing them in your answer sheet and complete the labels of each one :



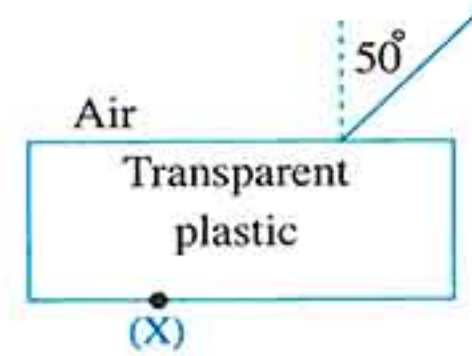


UNIT  
2

- (5) Complete the path of rays in each of the following figures according to what is written below each :



- a. Determination of the angle of reflection of the ray in mirror (Y).



- b. Calculating the angle of emergence from point (X) given that the optical density of air is less than plastic.

- (6) Look at the opposite figure, then answer :

1. The opposite figure indicates the ..... property.
2. The speed of light through air is ..... its speed through water.
3. Why does the pencil seem broken ?



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# Timss Questions



## 1. Choose the correct answer :

1. A person inside a dark room can see another person from the window. The outside person can't see the person in the room, this is because .....
  - a. there is no enough light reflected from the person inside the room.
  - b. the light rays can't penetrate the window.
  - c. light doesn't penetrate windows.
  - d. sunlight isn't intense enough as other light sources.

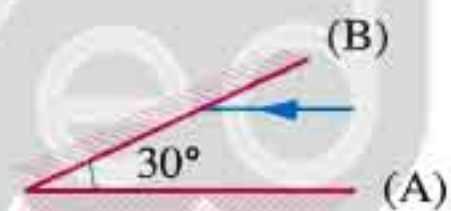
## 2. Which of the following figures represents light refraction :



## 2. Books and reference books aren't preferred to be printed on bright papers. Why ?

## 3. Draw the following figure, then :

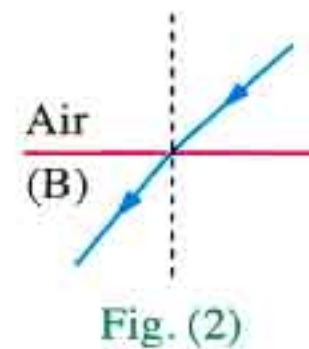
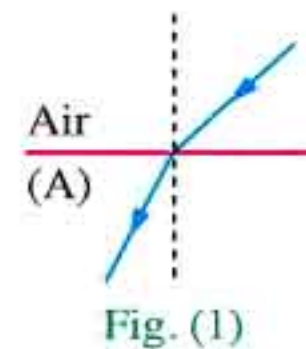
- a. Complete the pathway of light ray, which is incident parallel to the mirror (A) where it reflects from it.
- b. Find the angle of reflection from mirror (B).
- c. Find the angle of incidence on mirror (A).



## 4. These are values of absolute refractive index of five substances (1.5 - 0.8 - 1.8 - 1 - 1.3) Which of them are wrong ? Why ?

## 5. From the following figures :

Which of the two medium (A) or (B) has more optical density ? Why ?





## UNIT

## 3

Reproduction and  
Continuity of Species

## ▶ Lessons of the unit :

1. Reproduction in plants.
2. Reproduction in man.

## ▶ Unit Objectives :

By the end of this unit, students will be able to :

- Recognize the structure of a flower (bisexual – male and female).
- Deduce the functions of the bisexual flower's organs.
- Determine the sex of the flower.
- Deduce the types and methods of reproduction in plants.
- Use the materials and tools needed to study the germination of a pollen grain.
- Determine the concept of fertilization in plants.
- Deduce the methods of asexual reproduction in plants.
- Appreciate the importance of asexual reproduction in plants in preserving species.
- Appreciate the importance of plants in our life.
- Appreciate the importance of science and technology to human life & society.
- Recognize the structure of male and female genital system in man.





- Deduce the functions of male and female organs of the genital system in man.
- Compare between the functions of the human male and female genital system.
- Draw an illustration of the sperm and ovum.
- Identify some of the human genital system diseases in male & female human beings.
- Preserve his health by preventing infection by the diseases of the genital system.
- Commit to the healthy and right sexual attitudes.
- Commit to the right religious and social ethics connected with the human nature.
- Bear responsibility for preserving man's own health and man's genital system.
- Positive participate for social decision making regarding health issues concerned with preservation of man's health and birth control.



## Reproduction in plants



## How

do plants reproduce to secure their existence ?

- Reproduction process aims to secure the existence and continuity of living organisms species and to prevent them from extinction.
- Before studying reproduction in plants, you should study the flower as it is the organ of sexual reproduction in flowering plants.

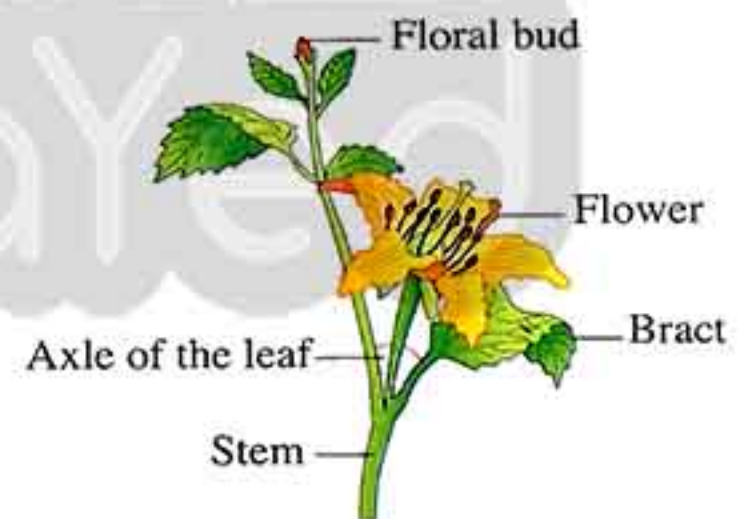
Flower :

It is a short stem whose leaves are modified into reproductive organs.

A

Origin of the flower :

- \* It arises from a floral bud which emerges from the axle of a leaf called bract.



The origin of the flower

Bract:

It is the green leaf, where the floral bud emerges from its axle and developed into a flower.

- \* The axle may carry a number of flowers which are known as inflorescence.

Inflorescence:

It is a group of flowers carried on the same axle.



Inflorescence



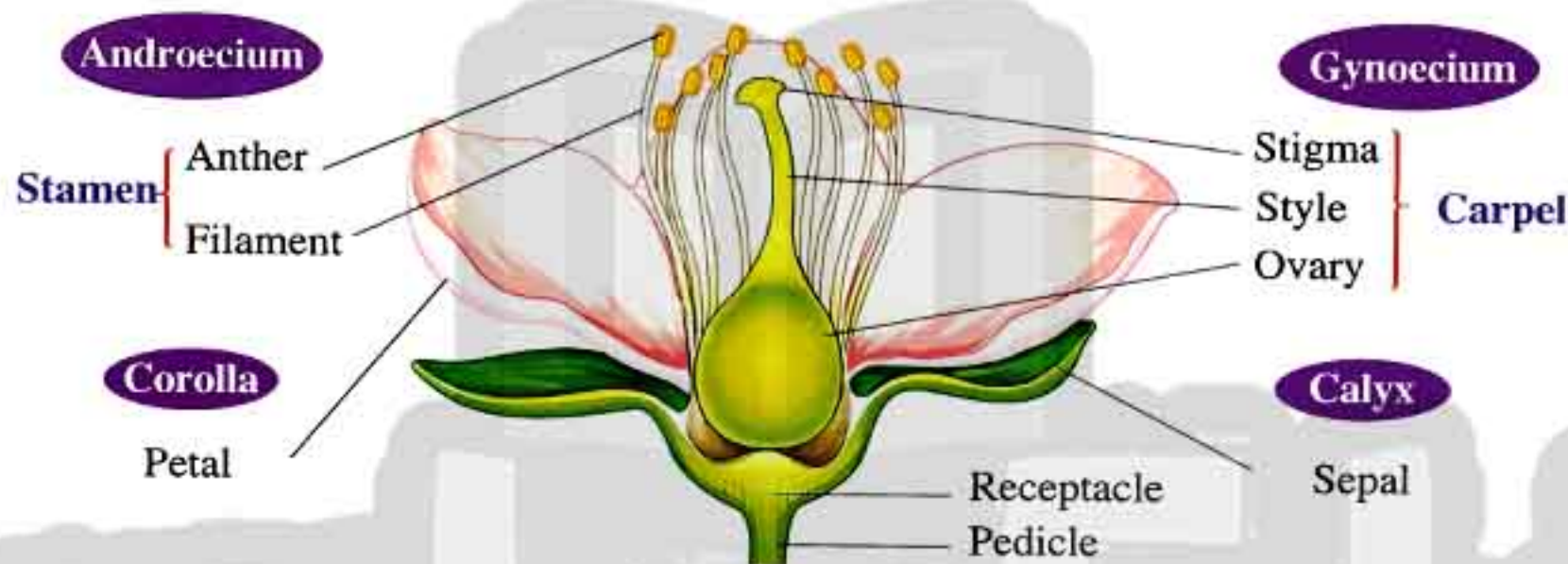
B

**The structure of the flower :**

If you examine a flower, you will notice that the flower has a thin neck (*pedicle*) ends in a swollen part (*receptacle*) which carries the floral leaves in four different floral whorls :

**Receptacle:**

It is the swollen part upon the flower pedicle, on which the floral leaves are existed.



The structure of a flower

**Questions** Answer the following questions :**A. Choose :**

- The flower is a modified .....  
a. leaf.      b. root.      c. branch.      d. stem.
- The receptacle carries the floral leaves in ..... floral whorls.  
a. three      b. four      c. five      d. six
- ..... consists of anther and filament.  
a. Carpel      b. Pedicle      c. Stamen      d. Calyx

**B. Write the scientific term :**

- It is the green leaf from which the floral bud emerges. (.....)
- It is the swollen part upon the flower pedicle, on which the floral leaves are existed. (.....)

**Answer**

- A.** 1. d      2. b      3. c  
**B.** 1. Bract      2. Receptacle.



UNIT  
3

➔ In the following figure, we will study the four different floral whorls :

## 1 Calyx :

1. It is the first (outermost) whorl of the floral leaves.
2. It consists of a group of green leaves, each leaf is called a "sepal".



Sepal

## Its function :

It protects the inner parts of the flower specially before blooming.

## 2 Corolla :

1. It is the second whorl (following the calyx) of the floral leaves.
2. It consists of a group of bright coloured scented leaves, each leaf is called a "petal".



Petal

## Its function :

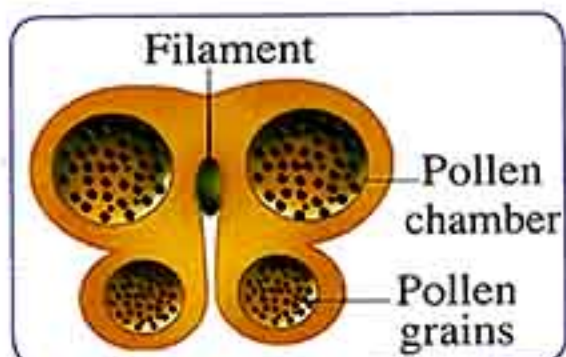
- It protects the reproductive organs.
- It attracts insects to the flower, which helps in the reproduction process.



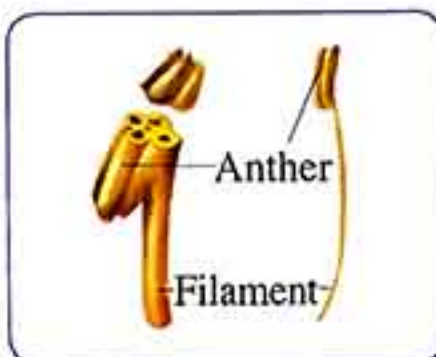
## 3 Androecium :

1. It is the third whorl (following the corolla) of the floral leaves.
2. It is the **male** reproductive organ of the flower.
3. Its leaves are known as "stamens".
4. Each stamen consists of a fine **filament** ends in a sac known as the **anther**, which is divided into two parts, each part has two chambers containing pollen grains.

**Its function :** It produces and holds pollen grains (inside the pollen chamber).



A cross-section in an anther

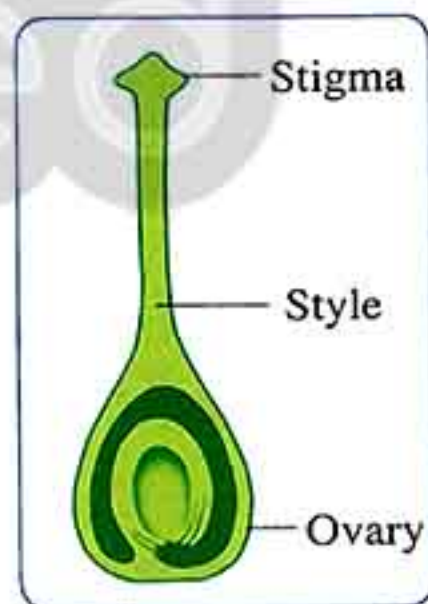


Stamen

## 4 Gynoecium :

1. It is the fourth (innermost) whorl of the floral leaves.
2. It is the **female** reproductive organ of the flower.
3. Its leaves are known as "carpels" which resemble the flask in shape.
4. Each carpel consists of a swollen part called the **ovary**, which is connected with a tube called the **style**, which ends in an opening called the **stigma**.

**Its function :** It produces ovules (inside the ovary).



Carpel



## Lesson One

\* We can summarize the four whorls and their functions in the following table :

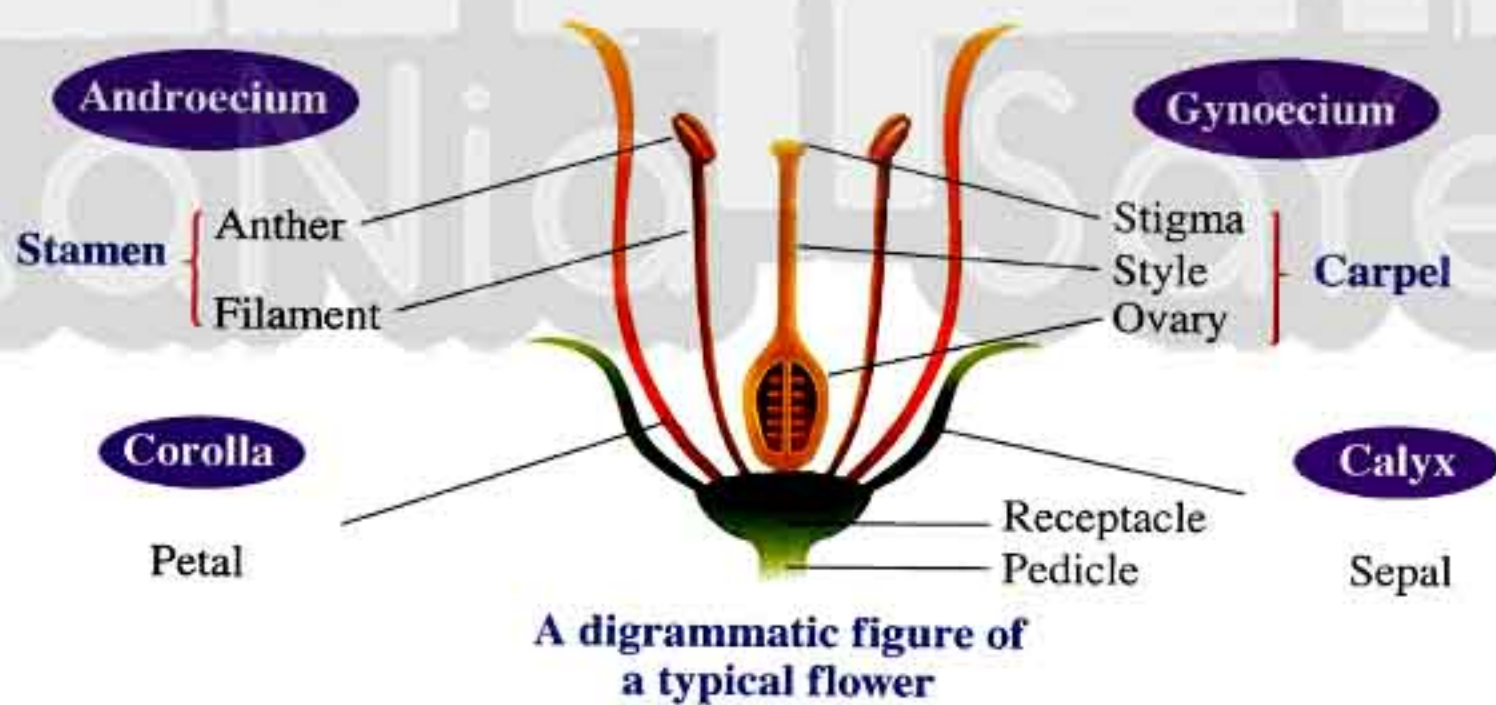
| Whorl         | Calyx  | Corolla  | Androecium                    | Gynoecium  |
|---------------|--|--|-------------------------------|--|
| Consists of : | Sepals   | Petals   | Stamens                       | Carpels  |
| Description : | Green leaves, surrounding the flower from outside. | Bright coloured scented leaves.                                  | Fine filament, ends in a sac. | It look like a flask, locates in the centre of the flower. |
| Function :    | Protection of the inner parts of the flower.       | - Attraction of insects.<br>- Protection of reproductive organs. | Production of pollen grains.  | Production of ovules.                                      |

### Typical flower :

The flower is considered as a typical flower if it contains the four different floral whorls.

### Typical flower:

It is the flower that contains four floral whorls.



**NB**



Flowers are different from each other in the separation or fusion of the sepals and petals, like in the flowers of wallflowers and Petunia.



UNIT  
3**Exercise** Answer the following question :

Compare between the flower of manthoor and the flower of petunia.

**Answer**

| The flower of manthoor   |        | The flower of petunia  |
|--|--------|--|
| 4 separated sepals.  | sepals | 5 fused sepals.  |
| 4 separated petals.  | petals | 5 fused petals.  |
|  |        |  |
| The flower of manthoor   |        | The flower of petunia  |

**Enrichment information**

- The sepals of calyx and petals of corolla might be of the same shape and colour as in onion flower, that's why we call the two whorls together the perianth.
- Hay - fever is a disease infecting people who have allergy to pollen grains, the symptoms of this disease are : inflammation of the mucus membrane of the nose , running nose, continuous sneezing and tear flow.

**The sex of flowers :**

Flowers are classified according to sex into two types

**Bisexual Flower****Bisexual Flower (hermaphrodite)**

Flower that carries both male and female reproductive organs.




**Unisexual Flower****Unisexual Flower**

Flower that carries either male or female reproductive organ only.



## Lesson One

➤ **Comparison between ? hermaphrodite flower, male flower and female flower :**

|                         | Hermaphrodite flower   | Male flower  | Female flower  |
|-------------------------|--|--|--|
| Flower Sex              | Bisexual   | Unisexual  | Unisexual  |
| Reproductive organs     | Stamen and carpel  | Stamen only  | Carpel only  |
| Symbol                  | ♀  | ♂  | ♀  |
| Shape                   |  |  |  |
| Number of floral whorls | 4  | 3  | 3  |
| Examples                | Tulip<br>petunia<br>Wall flower  | Palms<br>Maize<br>Pumpkins   | Palms<br>Maize<br>Pumpkins   |

GR.

- **The flower of the gelly plant is a bisexual flower.**

Because it carries both stamens and carpels together.

- **The flowers of palms are unisexual flowers.**

Because some of them contain only male reproductive organs (stamens) and the others contain only female reproductive organs (carpels).



### Real Life application : Drying - flowers

Pick up a bunch of flowers and remove the lowermost leaves from the flower pedicle, and organize them in groups to be tied to the pedicle.

Hang them in an upside down position in a dark, well ventilated room for one week.



Drying - Flowers

TRY

TO ANSWER worksheet  
in the Notebook



14



UNIT  
3

## Reproduction in plants :

There are two kinds of reproduction in plants

**First**  
Sexual  
reproduction

**Second**  
Asexual  
reproduction

## First Sexual reproduction in plants :

- This kind of reproduction happens via flowers.
- It takes place in two successive processes, which are :
  1. Pollination.
  2. Fertilization.

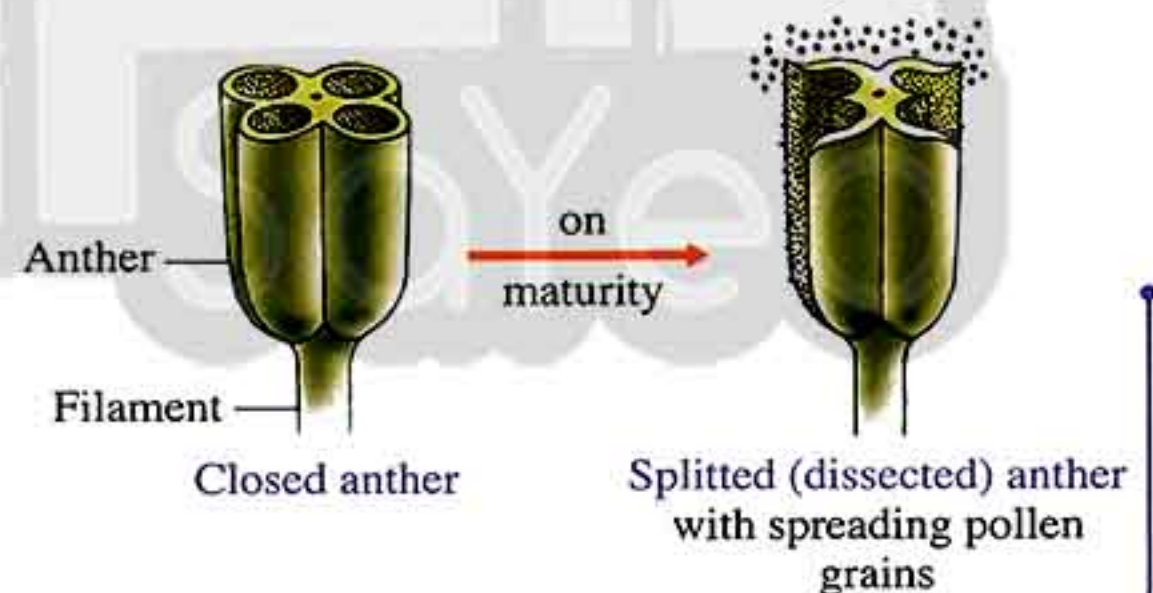
## 1 Pollination :

Pollination

It is the process of transfer of pollen grains from the flower anthers to the stigmas.

## Notes

- Pollen grains are small cells formed in the anther inside the pollen chamber.
- When those grains become mature, the anther splits longitudinally and the pollen grains spread in air like dust.



## Types of pollination

Self (auto) pollination

It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to another flower in the same plant.

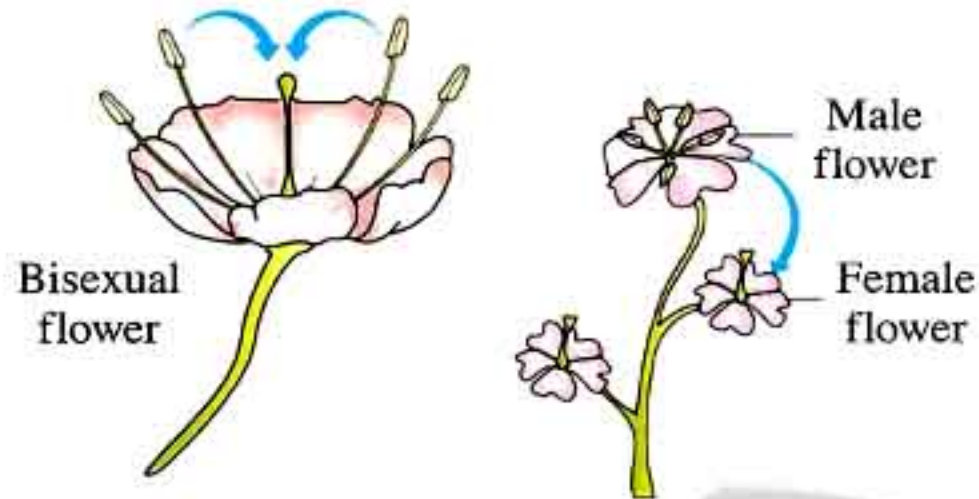
Mixed (cross) pollination

It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.

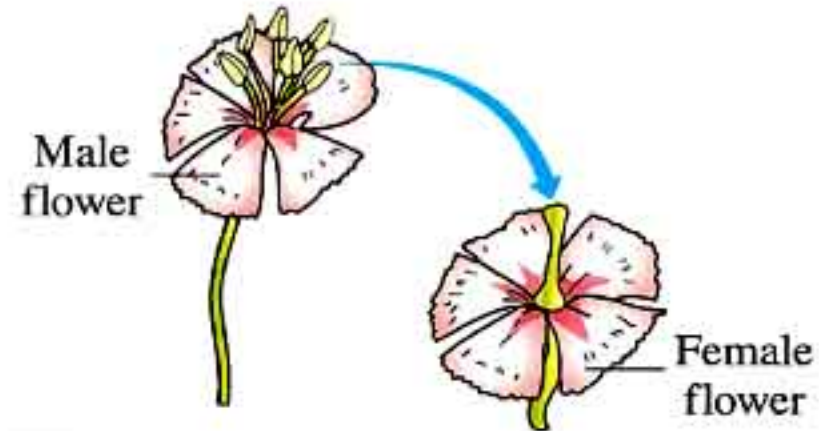


## Lesson One

## Self (auto) pollination



## Mixed (cross) pollination



## Reasons of occurrence

- Anthers and stigmas are matured in the same time.
- Non-blooming flowers until completion of fertilization process.

- Anthers and stigmas are not matured in the same time.

## Examples

1. Barley plant.
2. Flax plant.

1. Maize plant.
2. Sunflower plant.

## Give reason

- \* **The pollination in barley plant is self pollination.**  
Because its flowers never bloom until the completion of fertilization process.
- \* **The pollination in flax plant is self pollination.**  
Because the anthers and the stigmas are matured at the same time in the flower of this plant.

- \* **The pollination of maize plant is mixed pollination.**  
Because the flowers of this plant are unisexual flowers.
- \* **The pollination of sunflower plant is mixed pollination.**  
Because the anthers and the stigmas are not matured at the same time in the flower of this plant.

## Methods of mixed (cross) pollination :

Pollen grains are transferred from one flower to another by different ways, which are :

**A** Pollination by wind

**B** Pollination by insects

**C** Artificial pollination



## UNIT

## 3

## A

**Pollination by air (wind) :**

Some characteristics of flowers in which pollination is occurred by wind :

**Stigmas**

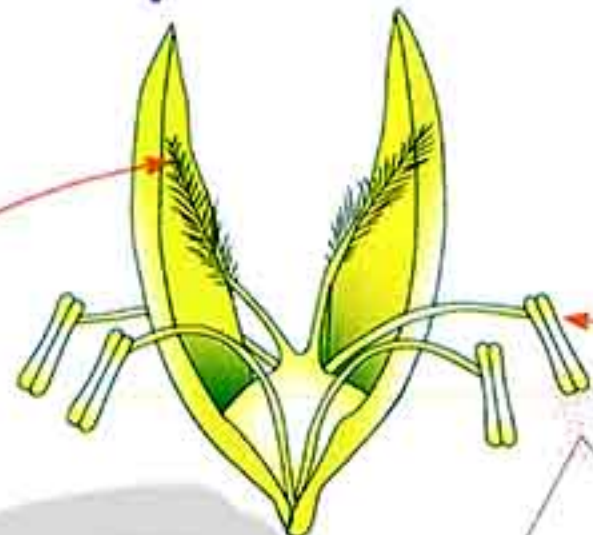
They are feathery like and sticky. **GR**  
To catch pollen grains from air.

**Anthers**

They are hanged **GR**  
To be easily opened by air.

**Pollen grains**

- \* They are produced by huge numbers. **GR**  
To compensate what are lost in air.
- \* They are light in weight and dry. **GR**  
To be easily carried by air.



A light and dry pollen grain (highly magnified).



The transfer of pollen grains by wind

**► Enrichment information**

Maize plant produces about 50 millions pollen grains.

## B

**Pollination by insects :**

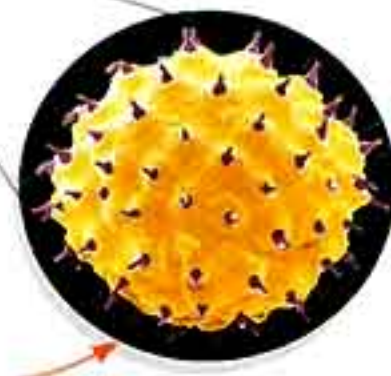
Some characteristics of flowers in which pollination is occurred by insects :

**Petal**

It is coloured and scented. **GR**  
To attract insects (like bees) to feed on their nectar.

**Pollen grain**

It is sticky or having coarse surfaces. **GR**  
To stick (adhere) on the insect body.



A coarse pollen grain (highly magnified)



## C Artificial pollination :

This method of pollination is carried out by human.

### Example

Palm trees where the gardener spread palm tree pollen grains over their female flowers.

GR

**Sometimes, human has to pollinate palm trees.**  
To ensure the pollination process as pollination is difficult to occur by air or by insects.



Pollination of palm trees



Pollen grains



## 2 Fertilization :

It is the process of fusion of the nucleus of the male cell (pollen grain) with the nucleus of the female cell (ovum) to form the zygote.



### ACTIVITY 1

To study pollen grain germination :



#### Materials and tools :

- Diluted sugar solution.
- Glass slides and covers.
- Water.
- Microscope.



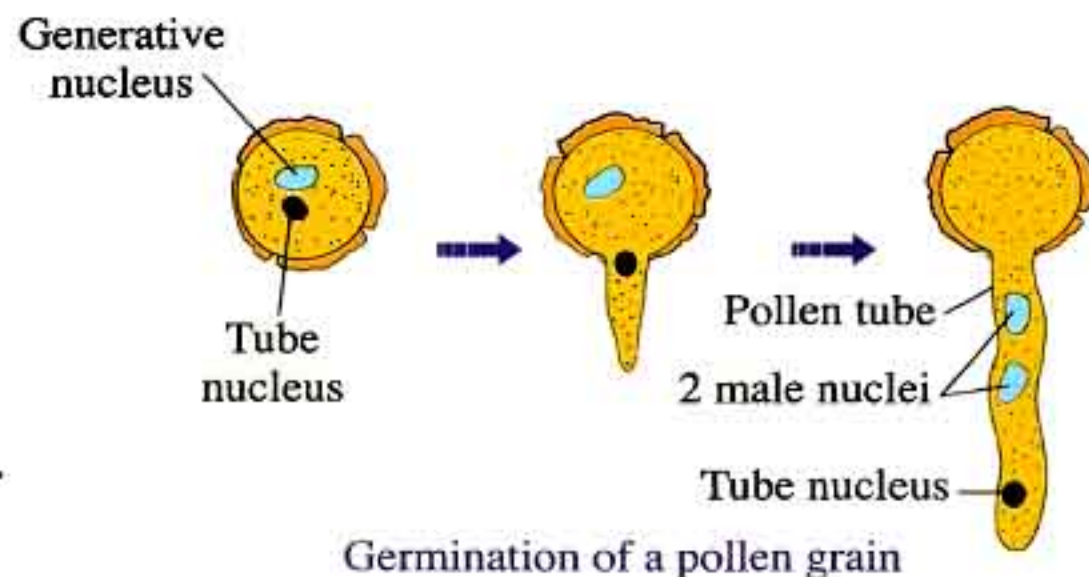
#### Steps :

1. Place a drop of the diluted sugary solution on a glass slide and put some pollen grains, then cover them with a glass cover.
2. Repeat the previous step with replacing diluted sugary solution by water.
3. Keep both slides in a dark and warm place for half an hour.
4. Examine the two slides under the microscope.



#### Observations & Conclusions :

- The pollen grain of sugary solution germinates by the formation of a pollen tube containing 2 male nuclei and one tube nucleus.
- This is similar to what happens to a pollen grain falls on a flower stigma.



Germination of a pollen grain

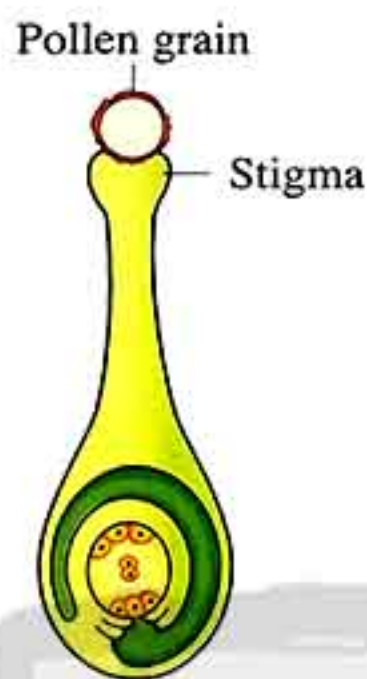


UNIT  
3

## Stages of fertilization process in plants :

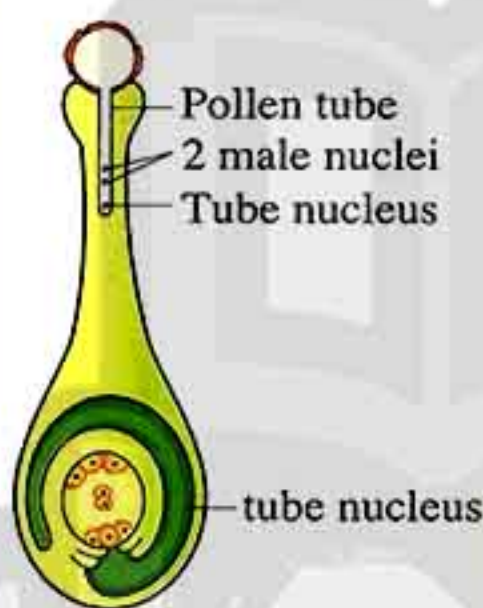
## Stage 1

After pollination, the pollen grain sticks on the stigma, which secretes sugary solution.



## Stage 2

The pollen grain germinates forming a pollen tube (containing 2 male nuclei).



## Stage 3

The pollen tube extends through the style till reaches the ovule inside the ovary through the micropyle.



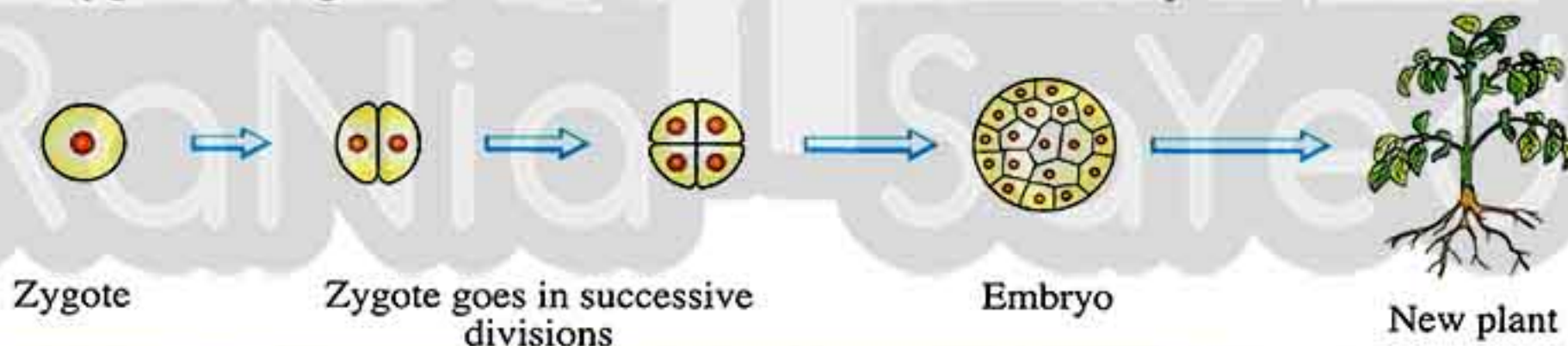
## Stage 4

The end of the pollen tube degenerates and one of the 2 male nuclei fuses (combines) with the ovum (egg cell) forming a fertilized ovum which is known as "zygote".



## Stage 5

The zygote undergoes successive divisions to form the embryo inside the ovule.



## Formation of seeds and fruits :

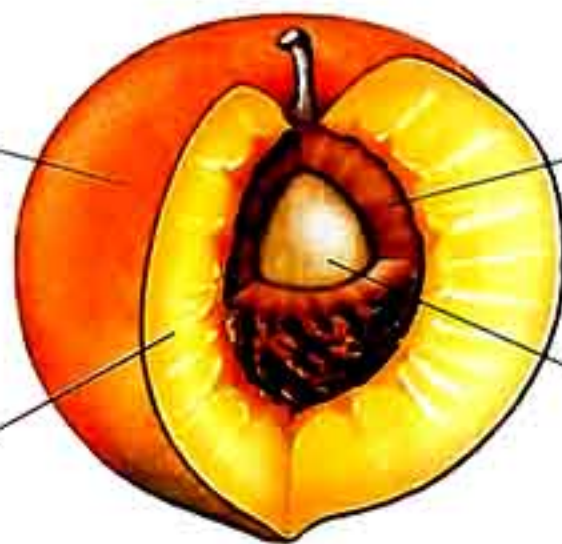
## After completion of fertilization process

## The wall of the ovary

It develops to become the outer coat of the fruit which is called "pericarp".

## The ovary

It develops to become a fruit.



## The wall of the ovule

It develops to become the seed coat.

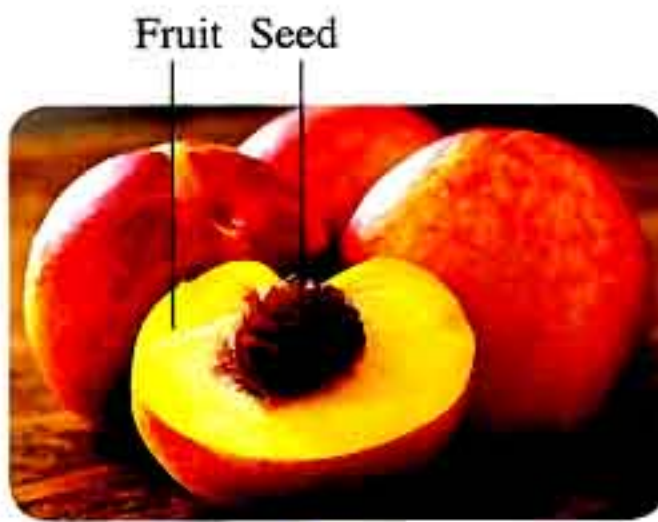
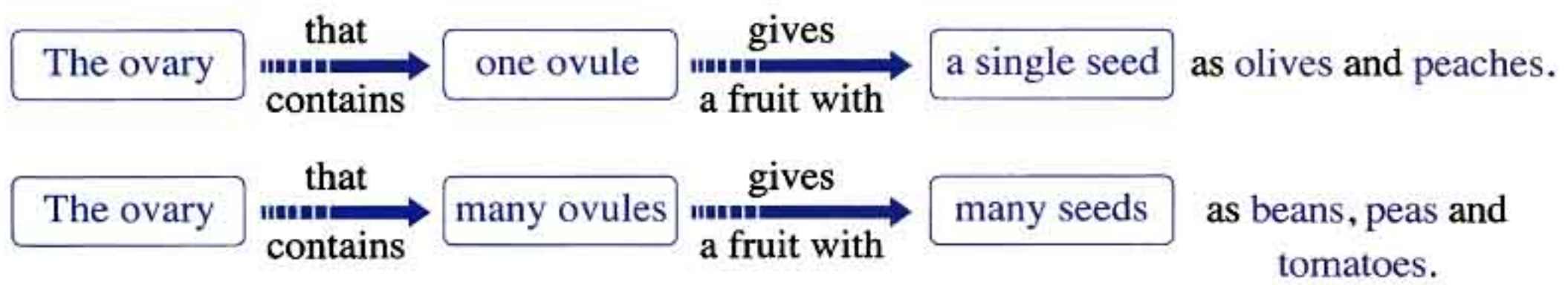
## The ovule

It develops to become a seed.

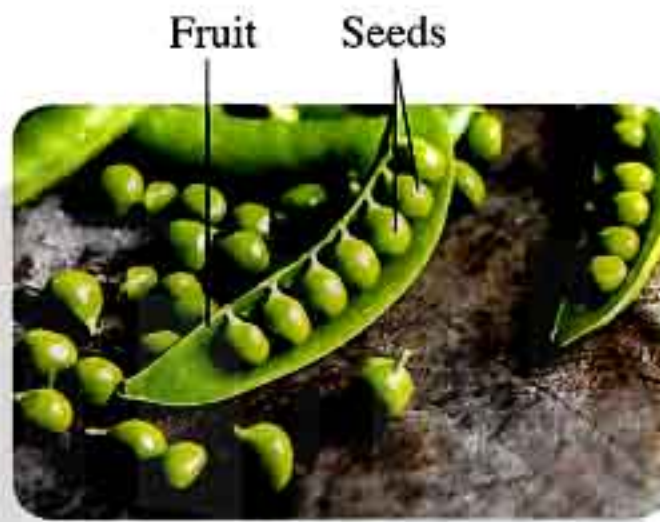


## Lesson One

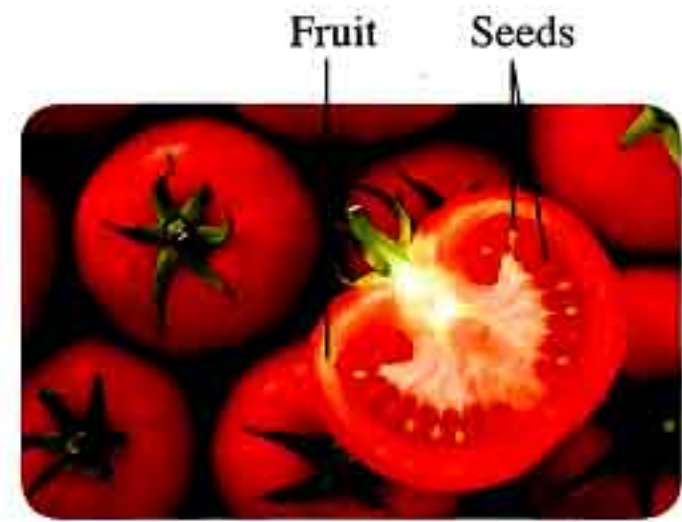
➤ Fruits differ from each other according to the nature of the ovary where :



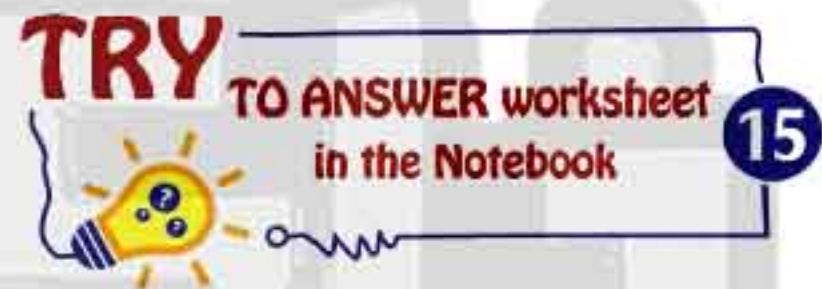
Peaches



Peas



Tomatoes



## Second Asexual reproduction in plants :

Some plants have developed special type of asexual reproduction called vegetative reproduction.

### Vegetative reproduction :

- It is a kind of asexual reproduction in plants.
- It takes place via parts of root, stem, leaves or buds.



There are two kinds of vegetative reproduction, which are :

#### 1 Natural vegetative reproduction

#### 2 Artificial vegetative reproduction

### 1 Natural vegetative reproduction :

- It takes place by many ways, such as reproduction by :
  - Rhizomes.
  - Corms.
  - Tubers.
  - Bulbs.
  - Offshoots.



UNIT  
3

⇒ We will study only one of them.

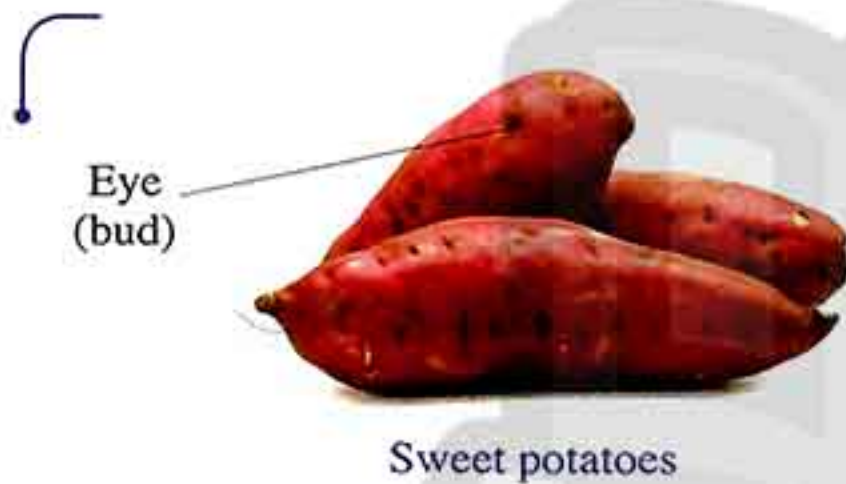
### Reproduction by tubers :

#### Tuber:

It is a swollen part from a horizontal root or a terrestrial stem, which contains growing buds and it is used for vegetative reproduction.

#### The tuber is :

A *root* as sweet potatoes.



or

A *stem* as potatoes.



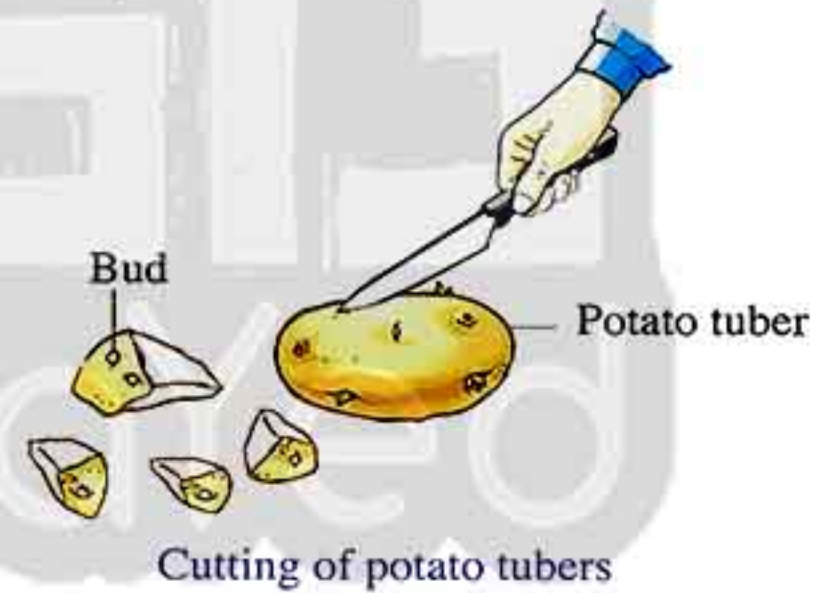
### ACTIVITY 2

To identify the reproduction by tubers.



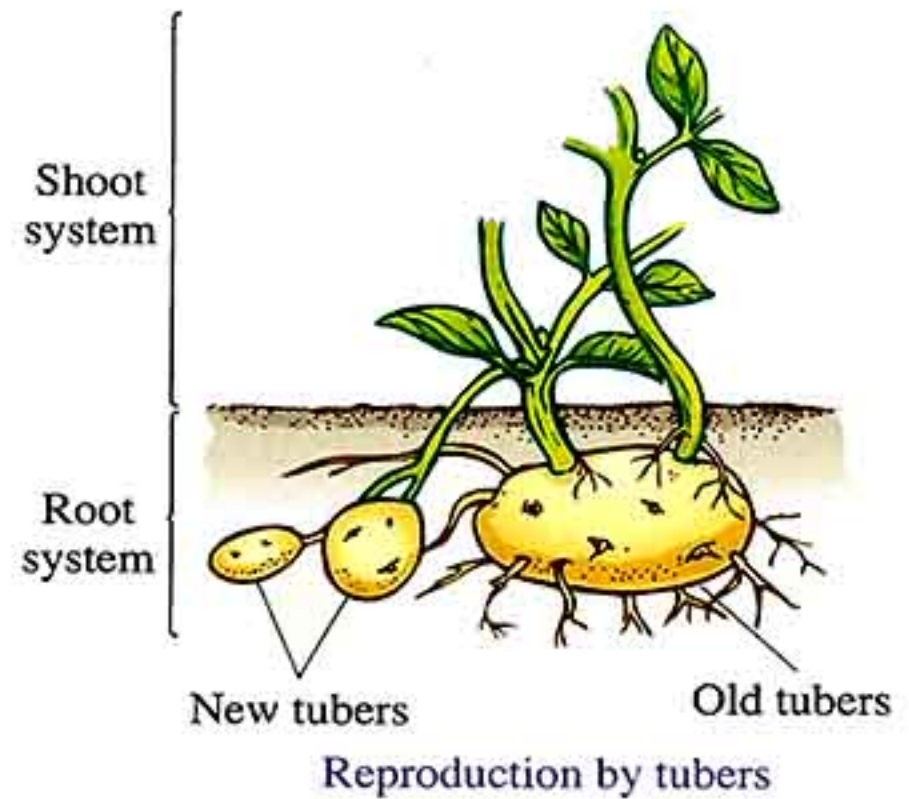
#### Steps :

1. Cut a tuber of potato into multiple slices, where each slice should contain a bud or more.
2. Cultivate these parts and water (irrigate) them regularly for a week.



#### Observations & Conclusions :

- Some buds grow forming a root system.
- Other buds grow forming a shoot system.
- After days, new tubers grow.





2

**Artificial vegetative reproduction :**

It takes place by four ways, which are :

1. Cutting.
2. Grafting.
3. Tissue culture.
4. Layering.

☞ We will study the first three ways only :

1

**Reproduction by cutting :**

The cut containing growing buds

**The cut :**

It is a part of root, stem or leaf that is taken from a plant for reproduction.

It is common for the cut to be a branch carrying many buds.

**Examples :** Grapes , roses and sugar cane.



Grapes



Roses



Sugar cane

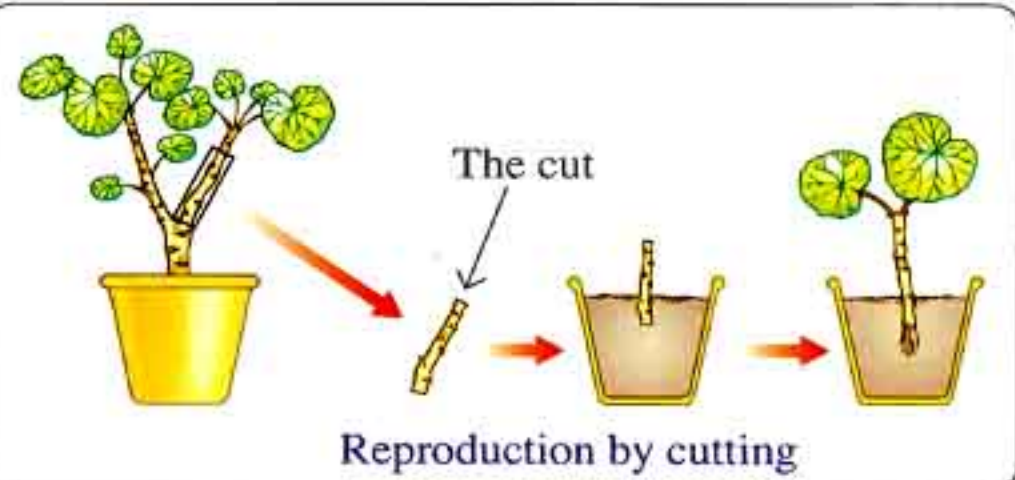
**ACTIVITY**

3

To identify reproduction by cutting.

**Steps :**

1. Get some cuts of different plants (grapes, roses, sugar cane, .....).
2. Cultivate them in a pot (or a can) full of soil. such a bud or more should appear above the soil surface.
3. Irrigate the cut regularly for two weeks.



Reproduction by cutting

**Observations & Conclusions :**

- The buds buried inside the soil grow to form the root system of the plant.
- The buds above the soil surface grow to form the shoot system of the plant.



UNIT  
3

NB

These shrubs are then transferred to the soil to grow more efficiently.

2

**Reproduction by grafting :**


In reproduction by grafting, a part of a plant which contains more than one bud, known as *scion* (graf), is selected to be placed on a branch of another plant known as the *stock*.

**Methods of grafting :****1 Grafting by attachment :****2 Grafting by wedge :**

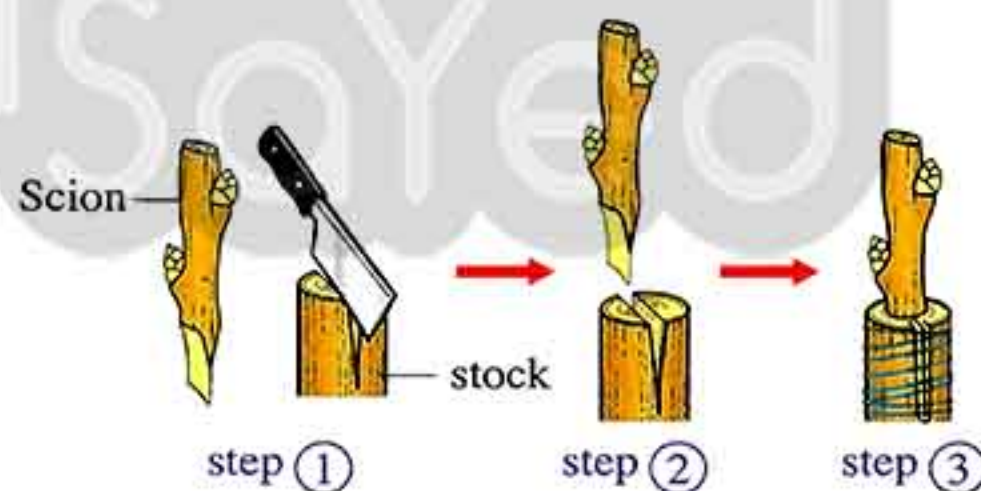
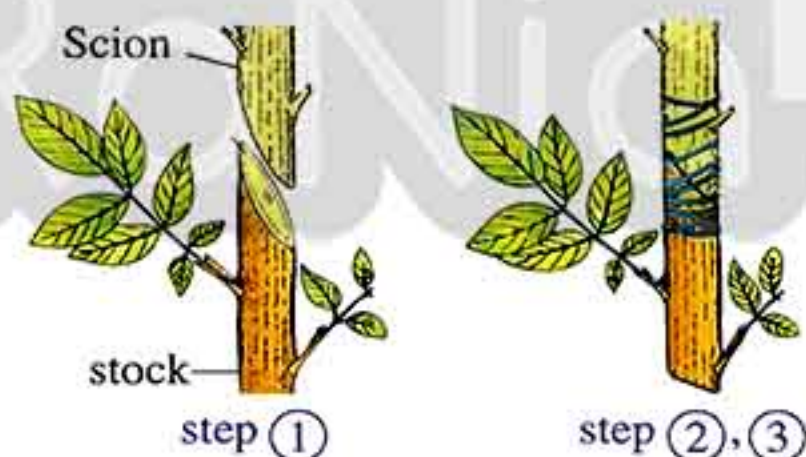
The two methods can be occurred by the following steps :

1. The scion and the stock are cut with two intergrated angles.
2. The scion is attached to the stock.

1. The scion is prepared in the form of a wedge (pencil shaped).
2. The scion is inserted into a cleft in the stock.

3. The scion and the stock are tightly tied together.   
To make the scion feed on the juice of the stock.

The following figures shows the previous steps :

**Example**

The grafting by attachment is occurred in:  
Mango trees.

The grafting by wedge is occurred in :  
Large trees.

NB

The produced fruits by grafting belong to the type of the scion.



## Lesson One

This kind of reproduction is used only between highly similar plant species such as :

1 Oranges and naring (bitter orange)



2 Apples and pears



3 Peaches and apricots



GR.

**The reproduction by grafting cannot be occurred between orange and peaches.**  
Because this kind of reproduction is used only between highly similar plant species.

► Enrichment information

*Gluing stem is a disease, which infects bitter orange trees and doesn't infect naring. That's why reproduction by grafting is useful when the disease spreads in orange fields. In this case orange is the scion while bitter orange is the stock.*

3

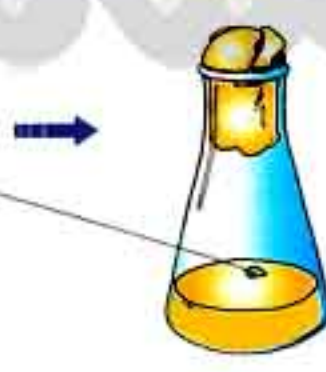
**Tissue culture :**

**Tissue culture :**

It is a process of multiplying a small part of a plant to get many identical parts.



The tissue is separated from the upper part of the stem



The tissue is placed in a nutritive medium containing nutrients and hormones



The new plant starts to grow till certain size



The new plant is then transferred to the soil to grow normally

Tissue culture from potato stem

GR.

**Tissue culture is considered from the important modern ways to increase crops.**

Because it is a process of multiplying a small part of a plant to get many identical plants.

TRY

TO ANSWER worksheet  
in the Notebook

16



# Remember

## ★ Flower :

It is a short stem whose leaves are modified to form different parts of a flower.

## ★ Inflorescence :

It is a group of flowers carried on the same axle.

## ★ Bract :

It is the green leaf, where the floral bud emerges from its axle and developed into a flower.

## ★ Receptacle :

It is the swollen part upon the flower pedicle, on which the floral leaves are existed.

## ★ Typical flower :

It is the flower that contains four whorls.

## ★ Floral whorls of the flower :

1. Calyx.
2. Corolla.
3. Androecium.
4. Gynoecium.

## ★ The sex of flowers :

1. Male flowers.
2. Female flowers.
3. Bisexual (hermaphrodite) flowers.

## ★ Reproduction in plants :

1. Sexual reproduction.
2. Asexual reproduction.

## ★ Self (auto) pollination :

It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to another flower in the same plant.

## ★ Mixed (cross) pollination :

It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.

## ★ Methods of mixed (cross) pollination :

Pollen grains are transferred from one flower to another by different ways, which are :

- a. Pollination by wind.
- b. Pollination by insects.
- c. Artificial pollination.



### ★ Fertilization :

It is the process of fusion of the nucleus of the male cell (pollen grain) with the nucleus of the female cell (ovum) to form the zygote.

### ★ Tuber :

It is a swollen part from a horizontal root or a terrestrial stem which contains growing buds and it is used for vegetative reproduction.

### ★ Natural vegetative reproduction :

It takes place by many ways such as reproduction by :

- Rhizomes.
- Corms.
- Tubers.
- Bulbs.
- Offshoots.

### ★ Artificial vegetative reproduction :

It takes place by four ways, which are :

1. Cutting.
2. Grafting.
3. Tissue culture.
4. Layering .

### ★ The cut :

It is a part of root, stem or leaf that taken from a plant for reproduction.

### ★ Methods of grafting :

#### 1. Grafting by attachment.

In which the scion and the stock are cut then the scion is attached to the stock.

**Example :** Mango trees.

#### 2. Grafting by wedge.

In which the scion is prepared in the form of a wedge (pencil shaped) and it is inserted into a cleft in the stock.

**Example :** Large trees.

In each of the two methods, the scion and the stock are tightly tied together to make the scion feed on the juice of the stock.


### ★ Tissue culture :

It is a process of multiplying a small part of a plant to get many identical plants.



# Questions

## on lesson one

Questions signed by  have been taken from the school book.

### 1. Choose the correct answer :

- The flower is a modified .....  
a. stem.                      b. leaf.                      c. root.                      d. branch.
- Inflorescence is a group of ..... on a floral axle.  
a. fruits                      b. leaves                      c. seeds                      d. flowers
- The floral leaves of a typical flower are arranged in ..... whorls.  
a. two                      b. three                      c. four                      d. five
- The outer whorl of the flower is called .....  
a. petal.                      b. calyx.                      c. androecium.                      d. corolla.
- The small green leaves that surround the flower from outside are known as .....  
a. petals.                      b. stamens.                      c. carpels.                      d. sepals.
- The corolla consists of a group of petals which .....  
a. protect the reproductive organs.                      b. attract insects to the flower.  
c. help in reproduction process.                      d. (a), (b) and (c) are correct.
- The filament and anther are structures of the .....  
a. carpel.                      b. stamen.                      c. stigma.                      d. sepal.
- ..... produces pollen grains.  
a. Carpel                      b. Style                      c. Stamen                      d. Petal
- The female reproductive organ of the flower is the .....  
a. stamen.                      b. carpel.                      c. corolla.                      d. androecium.
- The organ responsible for formation of the ova in the flower is the .....  
a. ovary.                      b. anther.                      c. corolla.                      d. receptacle.
- The floral whorl, which is absent (not found) in the female flower is the .....  
a. calyx.                      b. corolla.                      c. androecium.                      d. gynoecium.
- The bisexual flower contains .....  
a. only androecium.                      b. only gynoecium.  
c. androecium and gynoecium.                      d. no correct answer.
- All of the following are unisexual flowers except .....  
a. tulip.                      b. palm.                      c. maize.                      d. pumpkins.
- Which of the following flowers is a typical flower? .....  
a. Palm.                      b. Maize.                      c. Petunia.                      d. Pumpkins.
- The flower which contains both male and female reproductive organs is called ..... flower.  
a. male                      b. female                      c. unisexual                      d. hermaphrodite



## Lesson One

16. The innermost floral whorl of the male flower is the .....  
 a. gynoecium.      b. androecium.      c. corolla.      d. calyx.
17. Sexual reproduction in plants takes place via .....  
 a. seeds.      b. vegetative parts.      c. flowers.      d. fruits.
18. The process of transferring of pollen grains from the flower anthers to the stigma of another flower of the same plant is called .....  
 a. fertilization.      b. self-pollination.  
 c. cross pollination.      d. artificial pollination.
19. Flowers pollinated by air are characterized by all of the following except .....  
 a. hanged anthers.      b. feathery like stigmas.  
 c. scented petals.      d. light pollen grains.
20. The pollen grains of flowers pollinated by wind are .....  
 a. produced in huge number.      b. light in weight.  
 c. dry.      d. (a), (b) and (c) are correct.
21. In the flowers which have feather like stigmas, pollination is achieved through .....  
 a. water.      b. air.      c. man.      d. insects.
22. The pollen grains of the insect pollinated flowers are .....  
 a. large.      b. smooth.      c. sticky.      d. dry.
23. Mixed pollination in palm trees is carried out by .....  
 a. man.      b. insects.      c. air.      d. water.
24. The ovule contains ..... of the genetic material of the plant species.  
 a. half      b. all      c. quarter      d. third quarter
25. The zygote contains ..... of the genetic material of the plant species.  
 a. half      b. all      c. quarter      d. third quarter
26. The zygote undergoes successive divisions to form the ..... inside the ovule.  
 a. pollen grain      b. ovum      c. embryo      d. no correct answer
27. All of the following are fruits of single seed except .....  
 a. apricots.      b. olives.      c. peaches.      d. peas.
28. All of the following are ways of natural vegetative reproduction except .....  
 a. rhizomes.      b. bulbs.      c. fruits.      d. tubers.
29. The potato tuber is a .....  
 a. stem.      b. root.      c. leaf.      d. bud.
30. The sweet potato tuber is a .....  
 a. stem.      b. root.      c. leaf.      d. bud.
31. All of the following are ways of artificial vegetative reproduction except .....  
 a. grafting.      b. tissue culture.      c. corms.      d. cutting.
32. The cut is a part of ..... that is taken from a plant for reproduction.  
 a. root      b. stem      c. leaf      d. (a), (b) or (c)



UNIT  
3

33. It is common that a cut is a branch carrying many .....  
 a. buds.                      b. leaves.                      c. fruits.                      d. stems.
34. In reproduction by grafting, the part of plant containing more than one bud is known as .....  
 a. stock.                      b. cut.                      c. scion.                      d. bud.
35. Grafting by attachment can be carried to the ..... trees.  
 a. grape                      b. sugar cane                      c. rose                      d. mango
36. The produced fruits by grafting belong to the type of the .....  
 a. scion.                      b. cut.                      c. stock.                      d. bud.
37. Tissue culture is a process of multiplying small parts of a plant to get many ..... parts.  
 a. different                      b. similar                      c. identical                      d. small
38. In the tissue culture, the tissue is placed in a suitable medium that contains .....  
 a. nutrients and salts.                      b. nutrients and fertilizers.  
 c. nutrients and hormones.                      d. salts and hormones.


## 2. Choose from column (B) and (C), what's suitable for column (A) :

| (A)            | (A)         | (B)   |
|----------------|-------------|---|
| Floral whorl   | Consists of | Function                                    |
| (1) Calyx      | a. stamens  | 1. male organ in a flower.                  |
| (2) Corolla    | b. sepals   | 2. female organ in a flower.                |
| (3) Androecium | c. carpels  | 3. protects the inner parts of a flower.    |
| (4) Gynoecium  | d. petals   | 4. attracts insects to the coloured leaves. |


## 3. Put (✓) or (×) and correct what is wrong :

- The flower is the organ of asexual reproduction in flowering plants. ( )
- The group of flowers, which are grouped on the same axle is known as bract. ( )
- The swollen part, which carries the floral leaves is known as the pedicle. ( )
- Calyx is the outer whorl of floral leaves and it consists of a group of green sepals. ( )
- The corolla consists of bright coloured scented leaves. ( )
- Androecium is the female reproductive organ in the flower. ( )
- Each anther consists of two chambers containing pollen grains. ( )
- Gynoecium consists of a group of carpels. ( )
- Anthers produce ovules. ( )
- Each carpel consists of ovary, filament and stigma. ( )
- Tulip and petunia are hermaphrodite flowers. ( )
- Palm and maize are bisexual flowers. ( )
- The innermost whorl of female flower is the androecium. ( )







14. The male flower consists of three whorls. ( )
15. Sexual reproduction in plants takes place in two processes, which are fertilization then pollination. ( )
16. Pollination is the transfer of pollen grains from the flower's stigma to the anther. ( )
17. Auto (self) pollination occurs in barely plant. ( )
18. The anthers of air pollinated flowers are feathery like and sticky. ( )
19. The pollen grains of air pollinated flowers are sticky or with coarse surfaces. ( )
20. Flowers of hanging anthers are pollinated by insects. ( )
21. Insects pollinated flowers are characterized by coloured and scented petals. ( )
22. Palm trees are pollinated by air. ( )
23. The pollen tube contains two female nuclei and one tube nucleus. ( )
24. The zygote is a fertilized ovum. ( )
25. The wall of the ovary after fertilization forms the outer coat of the fruit. ( )
26. The ovary of beans fruits contains one ovule. ( )
27. Vegetative reproduction is a kind of sexual reproduction. ( )
28. In reproduction by cutting, buds buried inside the soil grow to form the shoot system. ( )
29. The insertion of the scion inside the stock is known as attachment grafting. ( )
30. Mango trees can be reproduced by wedge grafting. ( )
31. When an orange scion is attached to naring stock, the produced fruit belongs to naring. ( )
32.  Reproduction by tuber happens in orange and bitter orange. ( )
33. Grafting is a process of multiplying a small part of a plant to get many identical parts. ( )
34. In tissue culture, the tissue is separated from the lower part of the stem. ( )
35. In tissue culture, the tissue is placed in a soil. ( )

#### 4. Write the scientific term :

1.  Short stem where the leaves developed and modified into reproductive organs.
2. An organ of sexual reproduction in the flowering plants.
3. The leaf that the floral bud (which forms the flower) emerges from its axle.
4. A group of flowers found on the same axle.
5. The swollen part upon the pedicle on which the floral leaves exist.
6. The outer whorl of the floral leaves which consists of a group of sepals.
7. A floral whorl in the flower which protects the inner parts of the flower.
8. A floral whorl in the flower, whose function to attract insects inner because of it is colourful and scented.
9. A group of coloured leaves in flowers, each of them is called petal.
10. • The male reproductive organ of the flower.  
• The organ of the flower which consists of a group of stamens.



UNIT  
3

11. An organ in the flower, which consists of filament and anther.
12. • The female reproductive organ in the flower.
  - The innermost whorl of the floral leaves of a typical flower.
13. An organ in the flower, which consists of ovary, style and stigma.
14. Small minute cells are formed inside the anther of a flower.
15. The flower, which contains androecium only.
16. The flower, which contains gynoecium only.
17. • The bisexual flowers.
  -  The flowers, which contain both androecium and gynoecium.
18. The process of transfer of pollen grains from the flower anthers to the stigmas.
19. The transfer of pollen grains from the anther of a flower to the stigma of the same flower or to another flower in the same plant.
20. The transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.
21. A kind of pollination which is carried out by human.
22. The fusion of male cell nucleus (pollen grain) with the female cell nucleus (ovum) to form the zygote.
23. •  The cell resulting from the fusion of pollen grain and the ovum nuclei.
  - The fertilized ovum.
24. The position of the entrance of the male nucleus to the ovule inside the ovary.
25. The organ, which forms the fruit after fertilization.
26.  The reproduction of some plants by parts of the roots, stems or leaves.
27. A part of root, stem or leaf taken from a plant for reproduction.
28. A kind of asexual reproduction, which is used only between highly similar plant species.
29. The selected individual plant, which carries more than one bud in reproduction by grafting.
30. The method of grafting in which the scion is attached to the stock.
31. The method of grafting in which the scion is inserted into a cleft in the stock.
32. • A process of multiplying a small part of a plant to get many identical parts.
  -  A new method to produce large numbers of plants from a small part of it.

**5. Complete the following statements :**

1. The flower is a short ..... whose leaves are ..... to form reproductive organs.
2. The ..... is the organ of ..... reproduction in flowering plants.
3. The flower arises from a floral ..... which emerges from the axle of a leaf called .....
4. A number of flowers are grouped together on the floral axle to form .....
5. The flower has a thin neck called ..... ending in a swollen part called ..... which carries the floral leaves.



## Lesson One

6. The floral leaves of calyx have ..... colour and each one is called .....
7. .... is a group of colored leaves, each leaf is called a .....
8. The corolla attracts ..... to the flower, which helps in ..... process.
9. .... is the male reproductive organ of the flower, while ..... is the female reproductive organ.
10. Androecium is the ..... reproductive organ of the flower and it consists of a group of .....
11. Each stamen consists of a fine ..... ending in a sac known as the .....
12. The anther consists of ..... chambers, each of them contains a large number of .....
13. Gynoecium is the ..... reproductive organ of the flower and it consists of a group of .....
14. Each carpel consists of a swollen part called ..... which connects with a tube called ..... and ending in .....
15. Carpels produce ..... inside the .....
16. The bisexual flower contains ..... and ..... but the male flower contains ..... only.
17. .... and ..... are examples of unisexual plants, while ..... and ..... are examples of bisexual plants.
18. Hermaphrodite flowers take the symbol ..... , while male flowers take the symbol .....
19. There are two kinds of reproduction in plants, which are ..... reproduction and ..... reproduction.
20. Sexual reproduction in plants takes place in two successive processes, which are ..... then .....
21. .... is the transfer of pollen grains from the flower anthers to the .....
22. Types of pollination are ..... pollination and ..... pollination.
23. Pollination by air takes place in flowers whose anthers are ..... and their stigmas are ..... like and sticky.
24. Pollination process takes place by ..... in flowers, which produce dry and light pollen grains, while it takes place by ..... in flowers which produce sticky pollen grains.
25. .... pollination takes place by man, such as .....
26. After pollination the pollen grain germinates forming a ..... , which contains two ..... nuclei.
27. Fertilization is the process of fusing the male cell nucleus (pollen grain) with the ..... nucleus to form .....
28. After fertilization, the ovary grows forming the ..... , while the ovule converts into the .....







## UNIT

## 3

29. .... is an example of a fruit with a single seed, while .... is an example of a fruit with many seeds.
30. .... reproduction is a kind of asexual reproduction, which takes place via parts of ...., stem, leaves and ....
31. Kinds of vegetative reproduction are .... and ....
32. The tuber is a .... as sweet potatoes or a .... as potatoes.
33. On cultivating a tuber part of potato in the soil, some buds grow forming a .... and other buds grow forming a ....
34. Artificial vegetative reproduction is carried out in three methods, which are ...., .... and ....
35. On cultivating a cut in a soil, the buds buried inside the soil grow to form the ...., while buds above the soil surface grow to form ....
36. In reproduction by grafting, a part of a plant, which contains more than one bud known as .... is selected to be placed on a branch of another plant known as ....
37. The two methods of reproduction by grafting are the grafting by .... and by ....
38. In grafting by wedge, the scion is .... into a .... in the stock such as ....
39. In reproduction by grafting, the .... feeds on the .... of the stock.
40. Tissue culture is a process of .... a small part of a plant to get many .... parts.

### 6. Give reasons for :

1.  The petals of corolla are colourful and scented.
2. The androecium is the male reproductive organ of the flower.
3. The gynoecium is the female reproductive organ of the flower.
4. The flower of bean plant is a typical bisexual flower.
5.  Palm flowers are unisexual.
6.  Auto pollination can't happen in sunflowers.
7. Flowers pollinated by air having hanging anthers.
8. The stigma of air pollinated flowers are feathery like and sticky.
9. Pollen grains of air pollinated flowers are produced in a huge number.
10. Pollen grains of air pollinated flowers are light in weight and dry.
11. Flowers pollinated by insects have coloured and scented petals.
12.  Flowers pollinated by insects produce coarse pollen grains.
13. Sometimes, man has to pollinate palm trees.
14. Olive fruit contains only one seed, while bean fruit contains more than one seed.
15. Some plants can be reproduced without flowers.
16. Potato can be reproduced by tuber.
17. In reproduction by cutting, a part of the cutting must be appeared above the soil.
18. Reproduction by grafting can't be used between apples and peaches.
19. Tissue culture is a good method for plant reproduction.



**7. What is meant by ... ?**

1. The flower.
2. The bract.
3. Inflorescence
4. Calyx.
5. Corolla.
6. Androecium
7. Gynoecium.
8. Male flower.
9. Female flower.
10. Hermaphrodite (Bisexual flower).
11. Sexual reproduction in plants.
12. Pollination.
13. Self (auto) pollination.
14. Mixed (cross) pollination.
15. Fertilization.
16. Micropyle.
17. Vegetative reproduction.
18. The cut.
19. Reproduction by grafting.
20. Scion.
21. Grafting by attachment.
22. Grafting by wedge.
23. 📖 Tissue culture of a carrot plant.

**8. Mention one function of each of the following :**

1. The flower.
2. The receptacle.
3. Calyx.
4. Corolla.
5. Androecium.
6. Gynoecium.
7. Pollen tube.
8. Tissue culture.

**9. What happens ... ?**

1. When a pollen grain falls on the stigma of a flower.
2. To the anther when pollen grains become mature.
3. When the anthers of air pollinated flowers are not hanged.
4. When the stigmas of air pollinated flowers are not feathery like and not sticky.
5. When the petals of insect pollinated flowers are not coloured and with no scent.
6. When the pollen grains of insect pollinated flowers are not sticky and with a smooth surface.
7. If the stigma doesn't secrete sugar solution after its pollination.
8. When the pollen tube doesn't reach the ovule.
9. 📖 To the ovary (after fertilization).
10. 📖 To the zygote (after fertilization).
11. When the tuber has no buds.
12. When a cut is cultivated completely inside the soil.
13. If the scion has no buds in reproduction by grafting.
14. If the scion and stock are not tightly tied together.
15. If the tissue is placed in a medium without hormones in tissue culture process.



**10. Compare between :**

1. The calyx and corolla.
2. Androecium and gynoecium.
3. Male flower and hermaphrodite flower.
4. Self pollination and cross pollination.
5. Pollination and fertilization.
6. Olives fruit and beans fruit.
7. Natural and artificial vegetative reproduction.
8. Grafting by attachment and grafting by wedge.

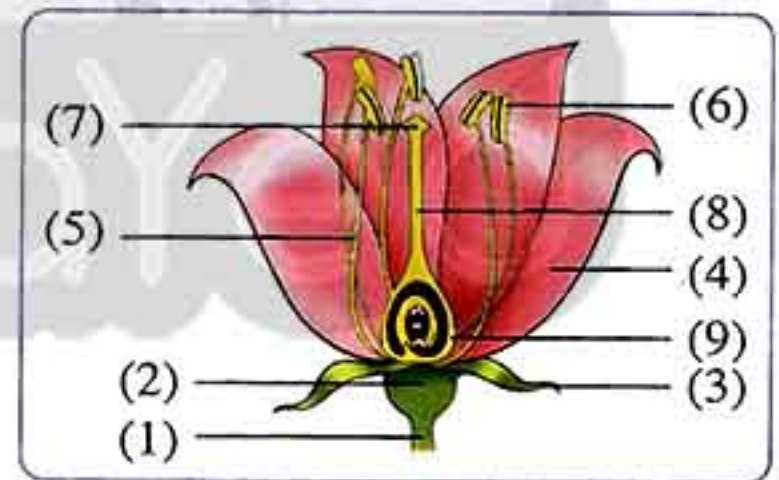
**11.** Exclude the unsuitable word, then write down the relation between the rest of words :

1. 📖 Stigma / Stamen / Style / Ovary.
2. 📖 Sepals / Petals / Tubers / Carpels.
3. Olives / Peaches / Apricots / Peas.
4. Tuber / Cutting / Grafting / Tissue culture.
5. 📖 Cutting / Pollination / Layering / Grafting.

**12.** Study the following figures, then answer the questions :

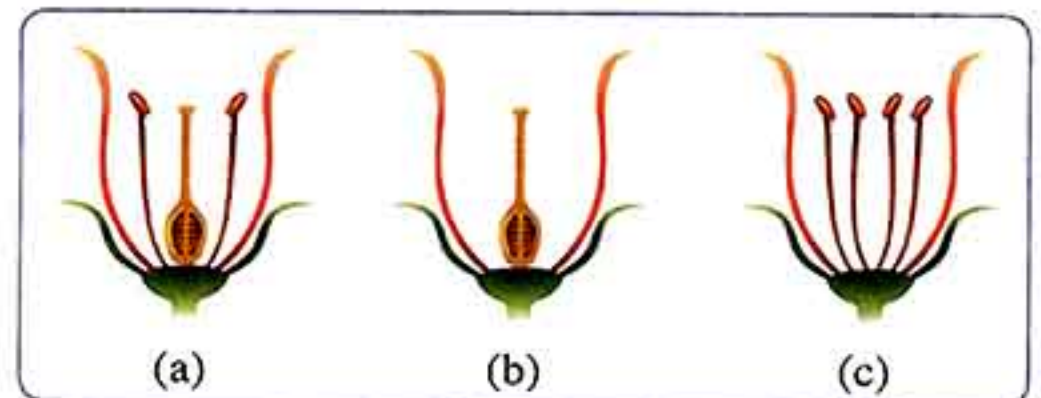
**(1) The opposite figure represents the structure of a typical flower :**

1. Label the figure.
2. What is the floral whorl, which consists of :  
a. part (3). b. part (4).
3. What is the kind of pollination, that happens in this flower ?
4. Mention one function of parts 3 , 4 , 6 , and 9
5. Mention the numbers of parts if they are removed, the flower becomes :  
a. male. b. female.



**(2) There are some different types of flowers in front of you :**

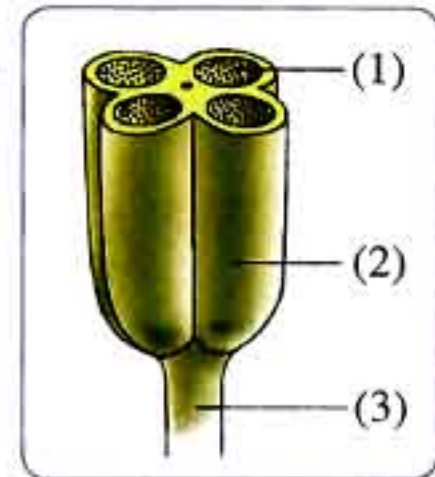
1. State the type of each flower.
2. In which one of these flowers, pollination can be mixed and in which one can be self pollination?  
Give a reason.





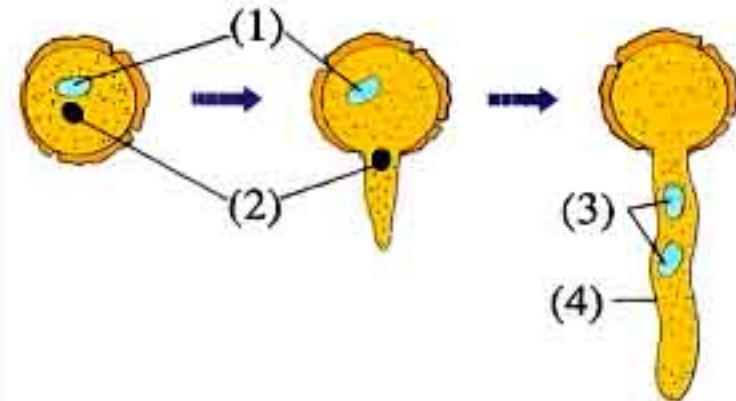
(3) The figure shown in front of you represents one of the constituents of a flower :

1. Mention its name.
2. Write the names which are indicated by the numbers (1),(2) and (3).
3. Mention its function.
4. What happens when part (1) becomes mature ?
5. What is the kind of pollination that happens when the structure number (1) falls on:
  - a. The stigma of the same flower ?
  - b. The stigma of another flower of another plant of the same kind?



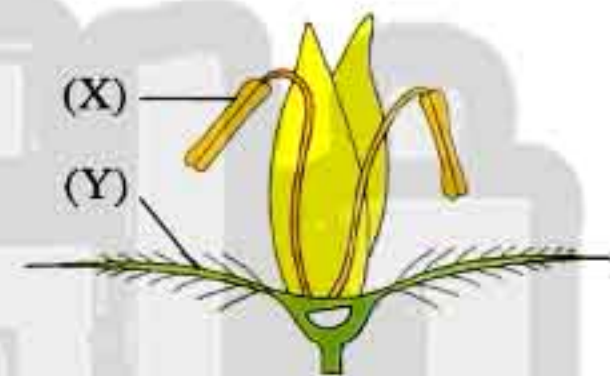
(4) From the opposite figure :

1. Write the labels of the figure.
2. The figure represents .....



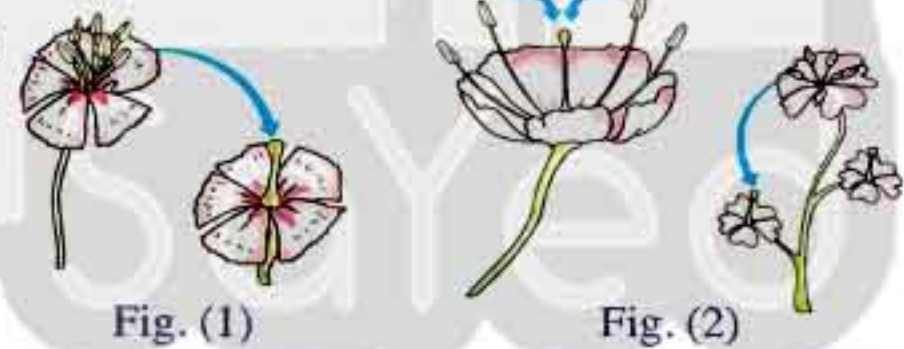
(5) The opposite figure shows a flower being pollinated by wind (air):

1. Write the labels for (X) and (Y).
2. Mention two characteristics that make this flower pollinated by air.
3. Explain how cross pollination happens in this flower.



(6) The opposite figures represent the pollination process:

Mention the type of pollination in each figure.  
Give reasons for your answer.



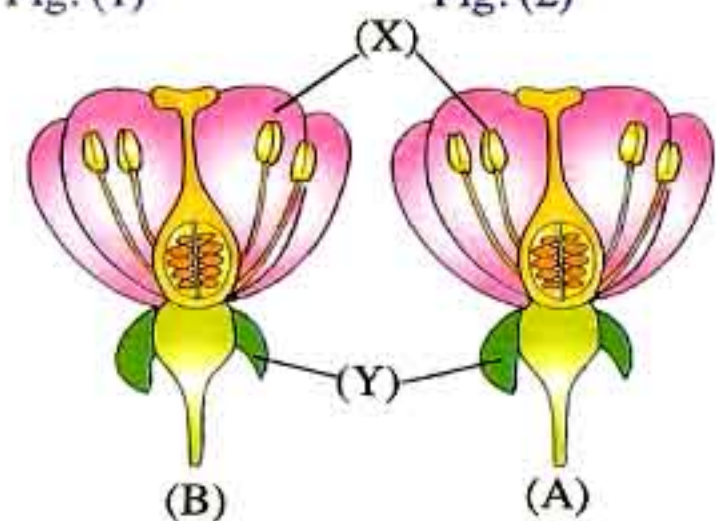
(7) The opposite two figures show two kinds of flower :

1. Mention the method of cross pollination in each figure. Give the reason.
2. Mention the characteristics of the produced pollen grains in each figure. Give the reason.



(8) The opposite figure shows two flowers of two plants of the same species :

1. What's the function of parts (X) and (Y) ?
2. Pollen grains from the flower (A) are transferred to the ova in flower (B) :
  - a. What's the type of pollination that happened ?
  - b. What's the sex of flower (A) ?



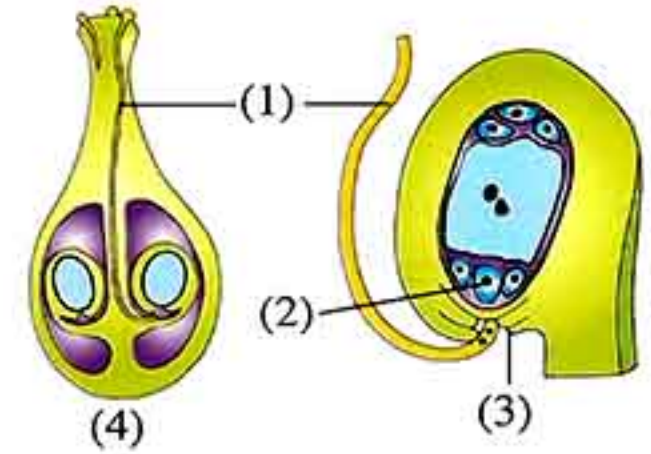


## UNIT

## 3

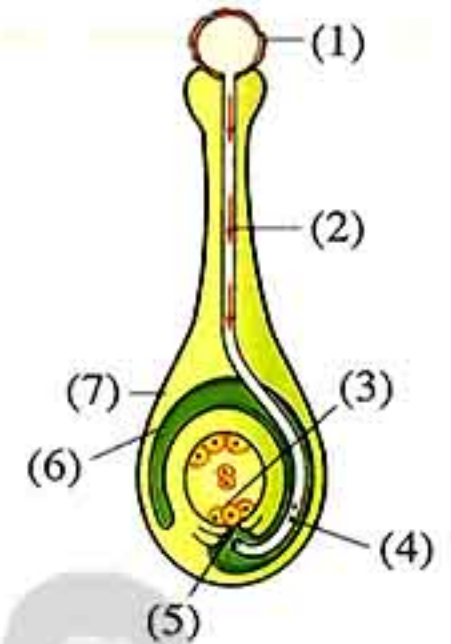
(9) The opposite figure shows a process of sexual reproduction in a flowering plant :

1. Write the labels of the figure.
2. Mention the name of this process.
3. What is the result of this process ?



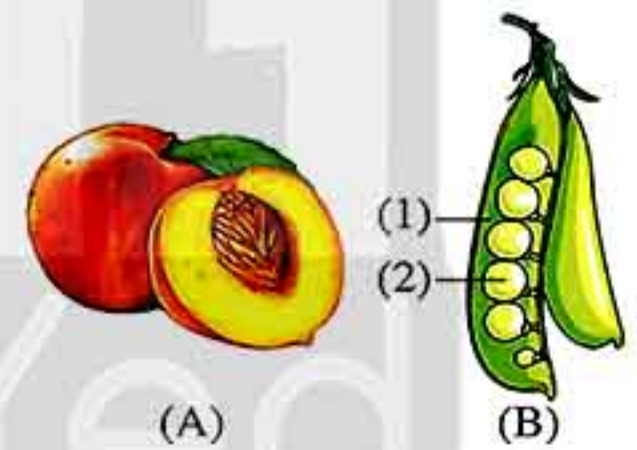
(10) From the opposite figures :

1. Write the labels of the figure.
2. What is the result of the combination of part (4) with part (3) ? and what is the name of this process ?
3. What is the number of the part which converts to :  
A. seed ?  
B. fruit ?



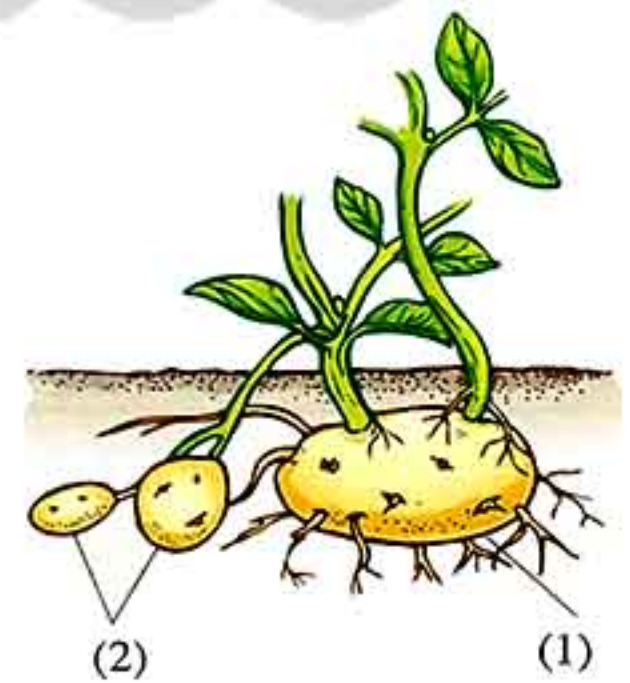
(11) From the opposite figures :

1. What is the sex of the flower of plant (A) ?
2. What is the origin of the figure (A) and the parts ① and ② in (B) before the completion of fertilization process ?
3. What is the difference between the ovary in the flowers of plant (A) and (B) ?



(12) The opposite figure represents a method of natural vegetative reproduction :

1. Mention the name of this method.
2. Label the figure.
3. Mention the steps of this method.





## Lesson One

(13) The following figures represent some ways of artificial vegetative reproduction:

1. Write the name of each method.
2. Label the figures.
3. Which method is used in mango trees ?

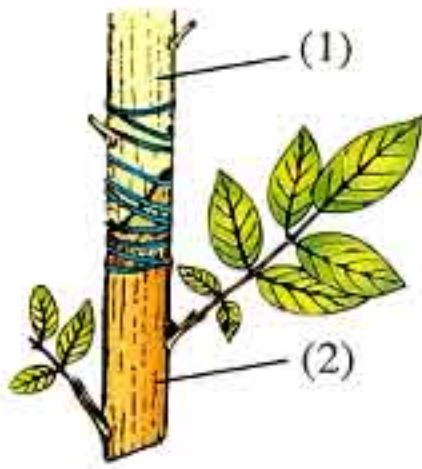


Fig. (1)

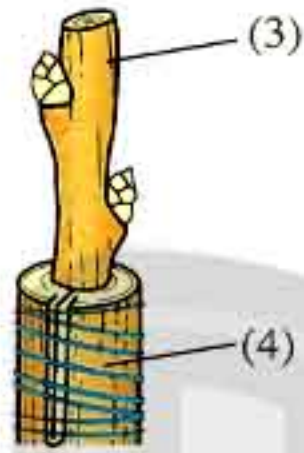


Fig. (2)

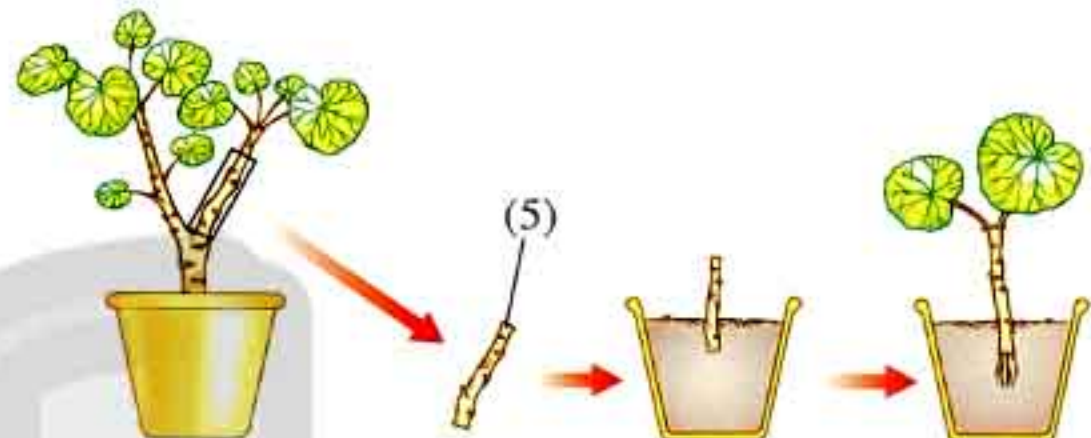


Fig. (3)

(14) The following figure represents steps of tissue culture from potato stem:

1. What is meant by tissue culture ?
2. Write down the description of each step.



Step (1)



Step (2)



Step (3)



Step (4)

.....  
 .....  
 .....

.....  
 .....  
 .....

.....  
 .....  
 .....

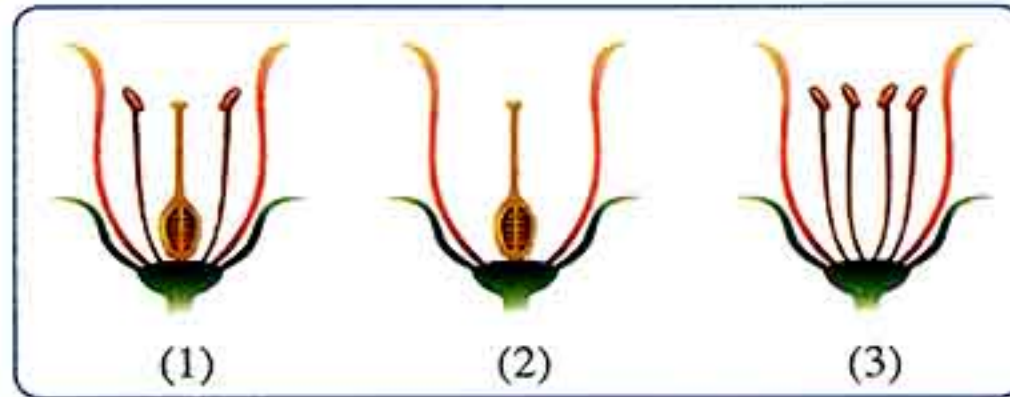
.....  
 .....  
 .....



# Timss Questions



- We can cultivate a piece of potato by cutting the tuber into multiple slices, each slice contains a bud. What is the type of this reproduction .....? (Explain)
  - sexual.
  - asexual.
- Which of the following characterizes reproduction by seed over the reproduction by tissue culture .....
  - production of plants in great numbers.
  - production of limited species.
  - variation of plant traits.
  - speed production of plants.
- Hermaphrodite Flower :**
  - contains male and female reproductive organs.
  - contains male reproductive organs only.
  - contains female reproductive organs only.
  - doesn't contain either male nor female reproductive organs.
- What happens if the flower loses its calyx before blooming ?
- Which of the following flowers can't form fruits ? Why ?





## Reproduction in Man



## Why

the reproduction process has a great importance for human beings ?

Humans reproduce sexually when two different persons mate, the male (♂) and the female (♀) using a special system called reproductive (genital) system.

Reproduction process :

It is a process that aims to secure the existence and continuity of living organisms species and to prevent them from extinction.

## NB

Man can't reproduce asexually, as the individuals (offspring) coming from asexual reproduction are identical to their parents, while in human, each individual differs from others.

## ➔ In this lesson, we will study :

1. The male reproductive system.
2. The female reproductive system.
3. The structure of the ovum and sperm.
4. Fertilization and embryo formation.
5. Genital system diseases.



## UNIT

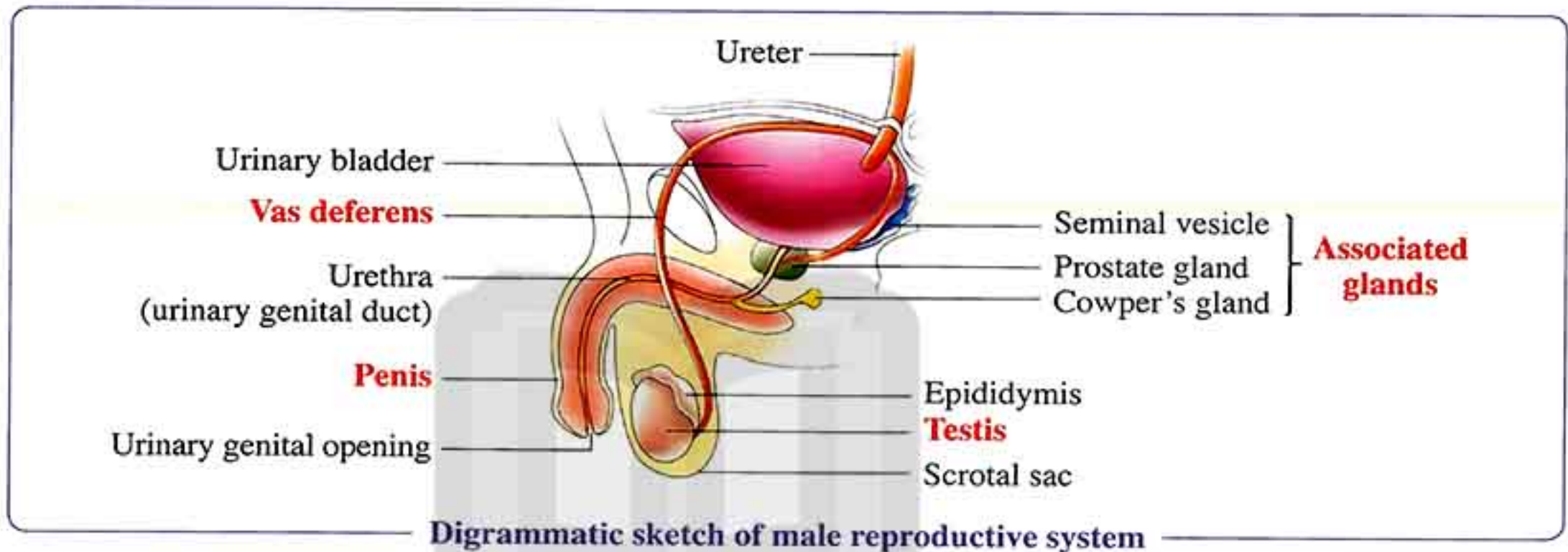
## 3

## 1

## The male reproductive (genital) system :

The male reproductive system consists of 4 main organs :

1. **Two testes.**
2. **Two vas deferens.**
3. **Associated glands.**
4. **Penis.**



## 1

## Two testes :

## Description :

They are two glands of oval (elliptical) shape.

## Position :

They locate outside the body in a sac like structure called *scrotal sac (scrotum)* which is hanged between male's thighs.

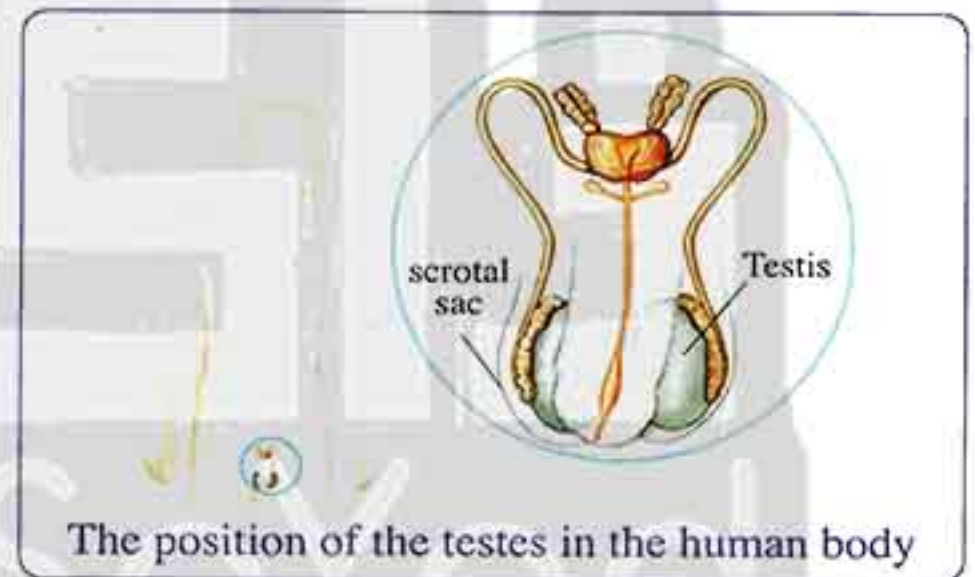
## Function :

## 1 Function of testes :

1. Production of sperms (after puberty).
2. Production of male sex hormone known as "testosterone" which is responsible for the appearance of secondary male sex characters (signs of puberty in male).

## 2 Function of scrotal sac :

It regulates and keeps the temperature of testes  $2^{\circ}\text{C}$  below the normal body temperature which is the optimum (suitable) temperature for the growth and development of sperms.



## Signs of puberty in male :

1. Growth of hair in certain body areas (like beard and mustache).
2. Harshness of voice.
3. Development of genital organs.
4. Growth of bones.
5. Enlargement of muscles.



## Lesson Two

## ► Enrichment information

*The testes of the elephant are present inside the body cavity. That's why it is surrounded by cooling system that preserves the optimum temperature for the testes to function efficiently and produce healthy sperms.*

NB

If the testes are present inside the body and don't come out during the development of the embryo, then sperms don't grow or develop and the individual becomes infertile (sterile).

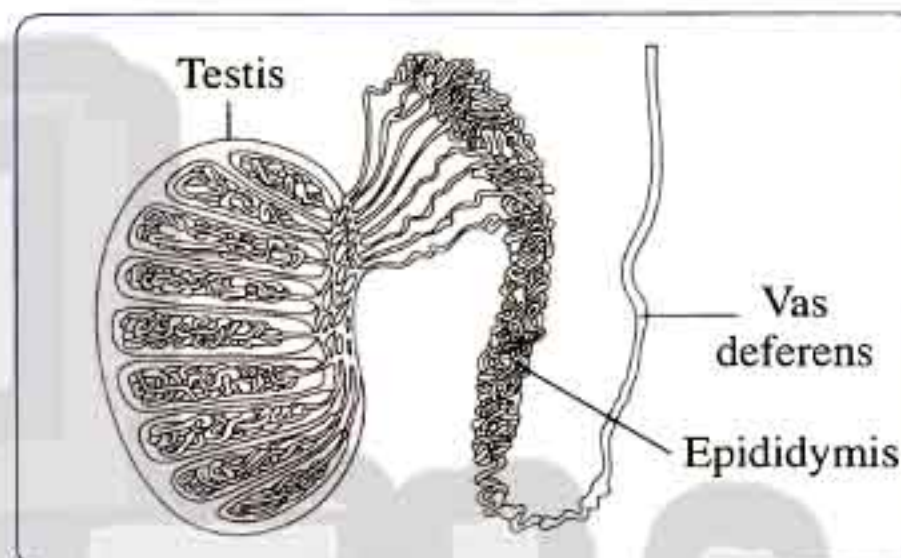
2

**The vas deferens :****Description :**

Each testis is connected to a group of fine convoluted (highly looped) tubes known as "Epididymis" which extends in the form of a single tube known as "Vas deferens".

**Function of epididymis :**

1. It stores the sperms.
2. The final stages of the growth and development of sperms take place in it.



The connection of the vas deferens with testis

**Function of vas deferens :**

It transfers the sperms from the testis to the urinary genital duct (urethra).

**What happens if the two vas deferens were cut ?**

The sperms can't transfer from the testes to the urinary genital duct and the individual becomes infertile.

3

**Genital associated glands :****Description :**

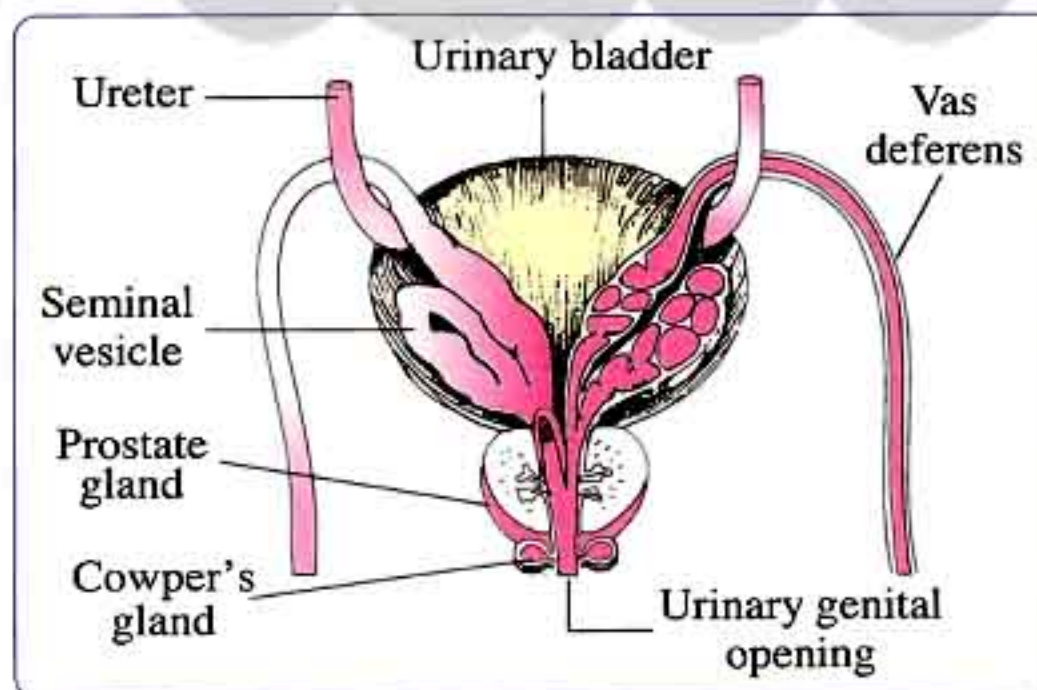
There are three kinds of genital glands connected to the male reproductive system, which are :

1. Two seminal vesicles.
2. Prostate gland.
3. Two Cowper's glands.

**Function of genital glands :**

They secrete an alkaline fluid known as seminal fluid which :

1. Nourishes (feeds) the sperms (as it contains nutrients).
2. Facilitates the flow of sperms.
3. Neutralizes the acidity of urethra (so sperms don't die during passing through urethra).



The associated glands of the male genital system

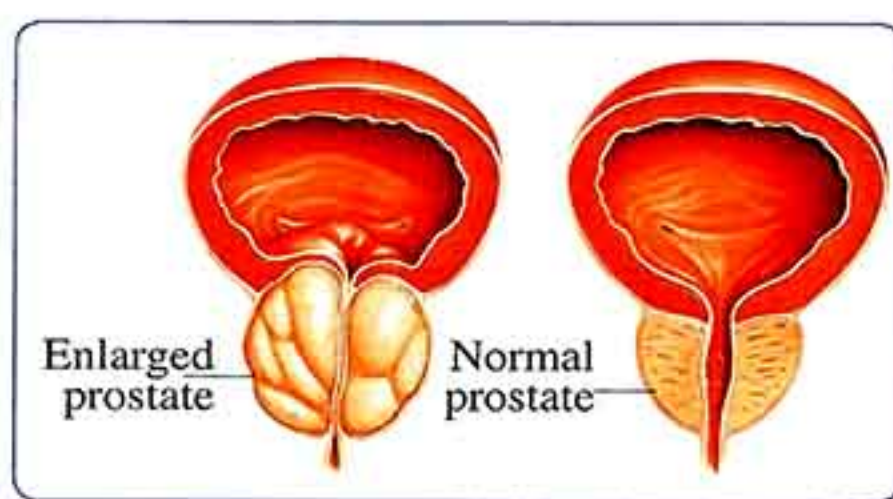


## UNIT

## 3

## ► Enrichment information

- The prostate is a muscular gland surrounding the urethra at the site of connection with the urinary bladder and it might be enlarged in some men above forty years.
- This leads to increase pressure on the urethra which eventually causes difficulty in urination, and needs to be removed surgically.



The enlargement of prostate

## 4

## The penis :

## Description :

It is a sponge-like tissue, the urethra passes through it and ends in a urinary genital opening.

## Function :

The semen and urine go out of the body through the penis but never at the same time.

## ? Question 1

Trace the path of the sperms from the beginning of its formation in the testes and even exit from the urinogenital opening.

## ✓ Answer

Testes → Epididymis → Vas deferens → Urethra → Urinary genital opening

TRY

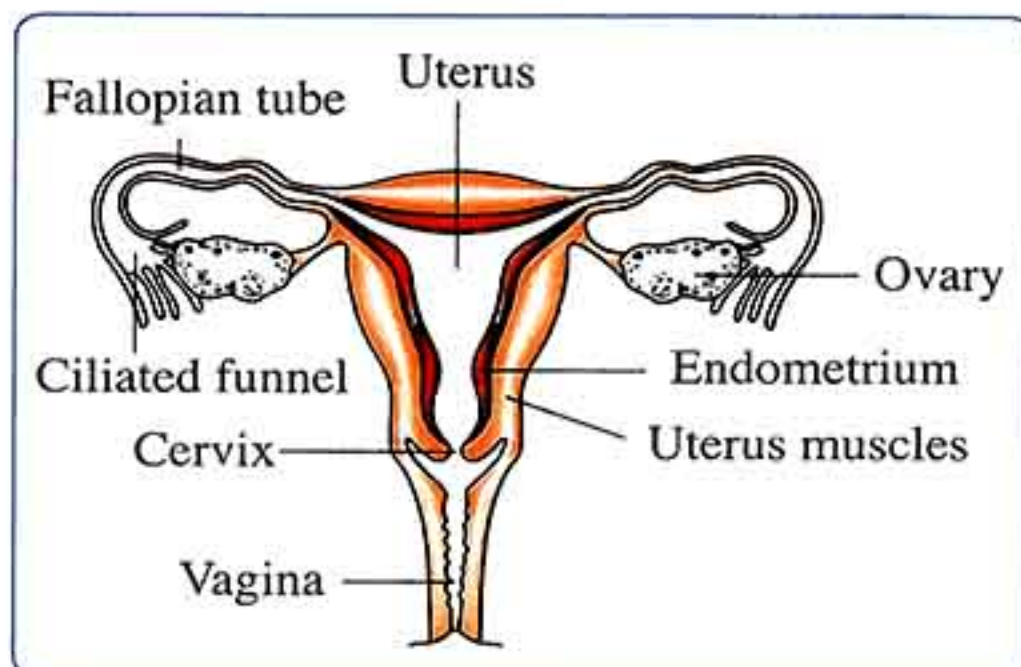
TO ANSWER worksheet  
in the Notebook

17

## 2

## The female reproductive (genital) system :

- The genital system in female differs from that in male in several aspects, mostly in being adapted to carry the embryo during the period of pregnancy.
- The female reproductive system consists of 4 main parts, which are :
  1. Two ovaries.
  2. Two fallopian tubes.
  3. Uterus.
  4. Vagina.



Diagrammatic sketch of female reproductive system



## Lesson Two

1

**Two ovaries :****Description :**

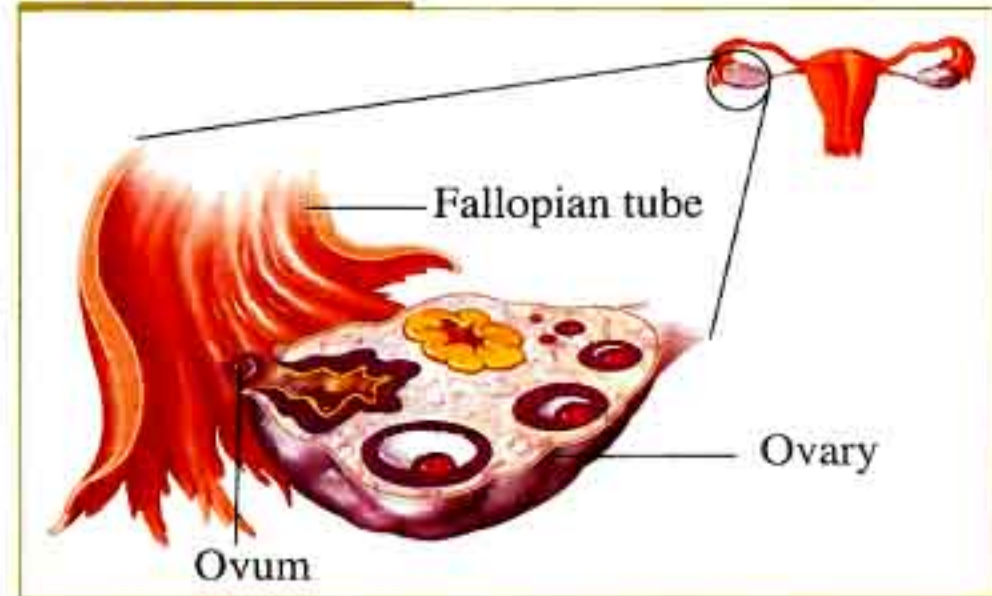
- They are two glands having the size of a peeled almond.

**Position :**

- They locate inside the body in the lower part of the abdominal cavity from the back.

**Function of ovaries :**

1. Production of ova, where each ovary releases one ripe ovum every 28 days in exchange with the other ovary in a process known as **ovulation**.
2. Production of female sex hormones, which are :
  - a. Progesterone, which is responsible for the continuity of pregnancy.
  - b. Estrogen, which is responsible for the appearance of secondary female sex characters (signs of puberty in female).

**For illustration**

The production of the ova and ovulation

**Signs of puberty in female :**

1. Growth of hair in armpit and pubic.
2. Softness of voice.
3. Growth and development of breasts.
4. Accumulation of fats in some body regions.
5. Occurrence of menstrual cycle every 28 days, as long as no pregnancy happens.

**NB**

Menstrual cycle starts at the age of female puberty (11 to 14 years) and stops at the age of menopause (45 to 55 years).

**? Question 2**

*Calculate the number of ripe ova that an adult woman can produce during 35 years, and what do you know about menopause ?*

**✓ Answer**

- ∴ The adult female produce one ripe ovum every 28 days.
- ∴ The number of produced ova in one year =  $\frac{365}{28} = 13$  ova
- ∴ The number of produced ova during 35 years =  $13 \times 35 = 455$  ova
- The menopause : It is the age in which the ovaries stop ovulation.



UNIT  
3

2

**Two fallopian tubes :****Description :**

- They are two tubes of funnel-shaped opening provided with finger-like projections.
- The inner wall of fallopian tubes lined with *cilia*.

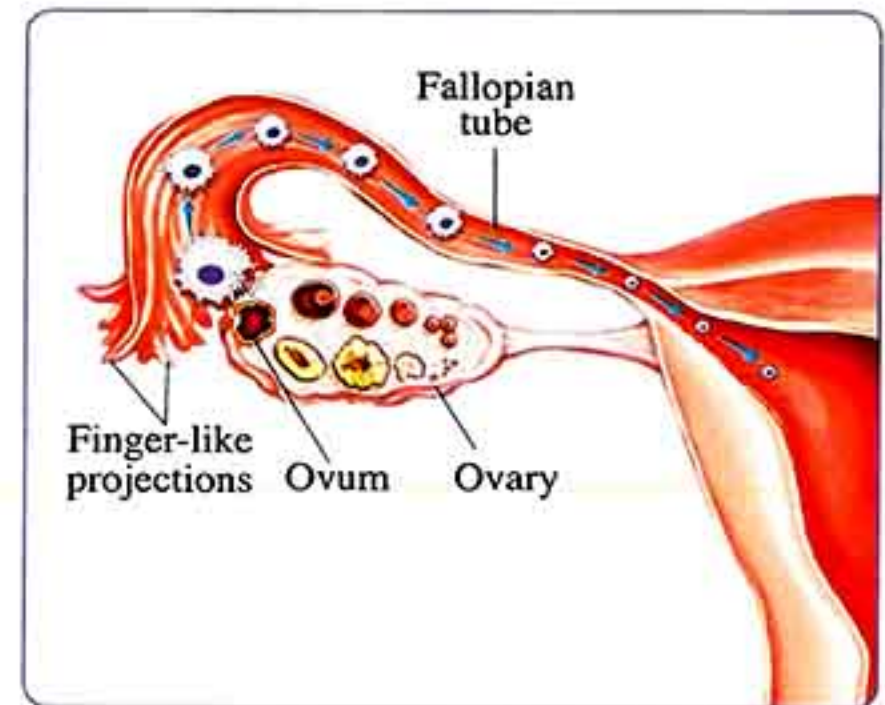
**Position :**

- The two fallopian tubes are located near to the ovaries and open in the upper corners of the uterus.

**Function of fallopian tubes :**

They receive (trap) the ripe ovum and direct it towards the uterus with the aid of :

- The contractions and relaxations of the muscles in the tubes wall.
- The movement of the lining cilia.



The motion of ovum in fallopian tube

GR.

- **Fallopian tube starts with a funnel-shaped opening provided with finger like projections.**

To receive the ripe ovum.

- **The inner wall of fallopian tubes is ciliated.**

To direct the ripe ovum towards the uterus.

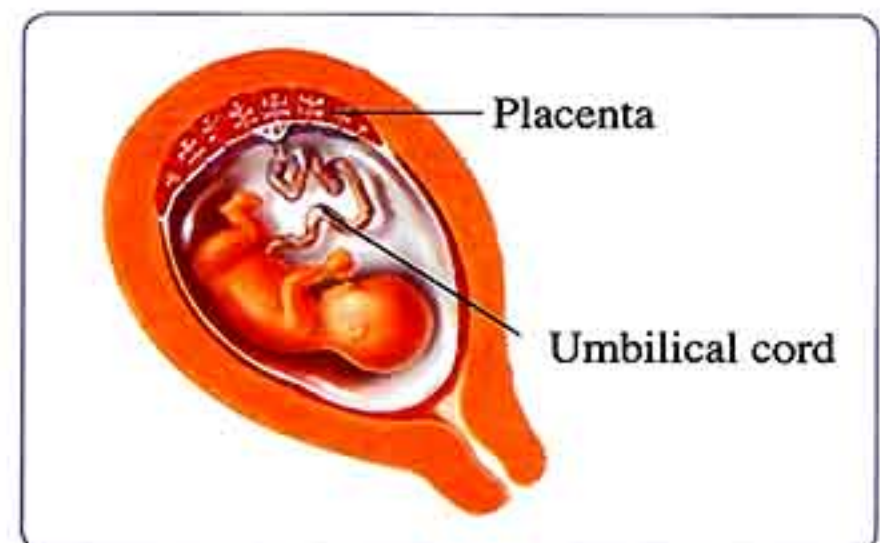
- **Fallopian tubes ligation is considered as one of the means of birth control.**

Because the ripe ovum doesn't reach the uterus, so pregnancy doesn't happen.

3

**The uterus (womb) :****Description :**

- It is a hollow pear-shaped organ.
- It has a muscular wall that can expand as the fetus grows during pregnancy.
- It is lined with mucus membrane rich in blood capillaries to form *placenta* which responsible for nourishment of the fetus during pregnancy through the *umbilical cord*.



Nourishing the embryo in the uterus



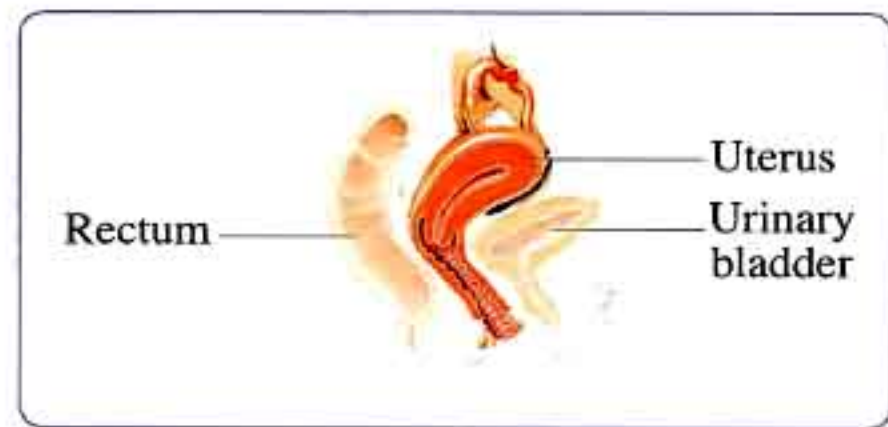
## Lesson Two

**Position :**

It locates in the pelvic cavity between the urinary bladder and the rectum.

**Function :**

It protects and nourishes the fetus during the pregnancy until birth.



The position of the uterus



**The uterus is a suitable organ for the growth of the embryo.**

Because it has thick muscular wall that is rich in blood capillaries, which feed the embryo, supply it with oxygen and it also protects the embryo until birth.

4

**The vagina :****Description :**

It is a muscular tube.

**Position :**

It extends from the uterus and ends in the external genital opening.

**Function :**

Expands during the labour to deliver (coming out) the baby.



The expansion of the vagina during the labour

**Question 3**

*Trace the path of the un-fertilized ovum from its formation till its decomposition, then it exists in the menstrual blood.*

**Answer**

Ovary → Fallopian Tubes → Uterus → Genital opening.

**From the previous study, you know that :**

- In male : testes produce sperms (male gametes).
- In female : ovaries produce ova (female gametes).
- \* Before studying the fertilization process, you must know the structure of the sperm and ovum.



UNIT  
3

## 3

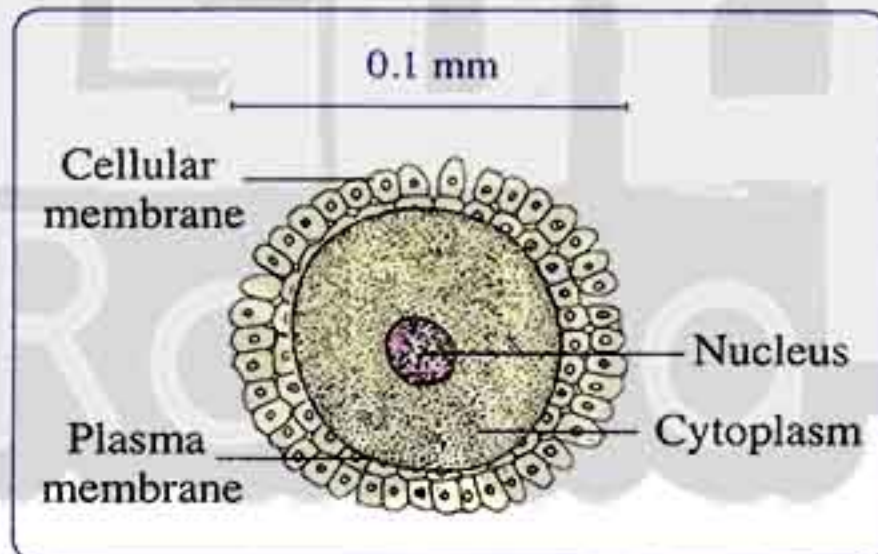
## The structure of the ovum and sperm :

## 1 The structure of the ovum :

- It is large in size (as sesame seed size) due to the storage of nutrient materials.
- It is a spherical cell and not mobile (static).
- It consists of :

1. **The nucleus**, that contains one half of the genetic material (chromosomes).
2. **The cytoplasm**, that stores food and nutrients.

3. **The cellular membrane**, that surrounds (coats) the cell from outside.

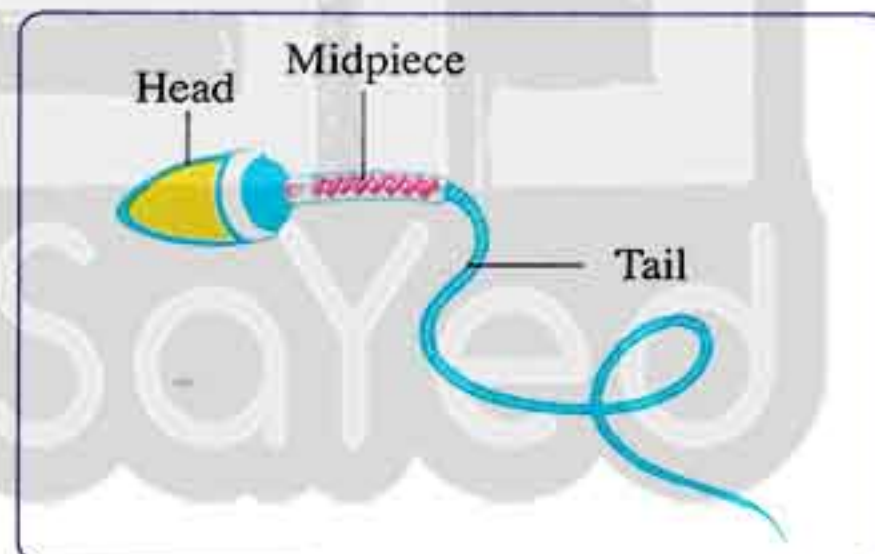


The structure of the ovum

## 2 The structure of the sperm :

- It is considered very small if it is compared with the ovum.
- It is mobile.
- It consists of :

1. **The head**, that contains one half of the genetic material (chromosomes).
2. **The midpiece**, that contains mitochondria responsible for energy production needed for the sperms movement.
3. **The tail**, (thin and long) it is responsible for the movement of the sperm till reaches the ovum.



The structure of the sperm

## ► Enrichment information

- The testes of the adult human male produce about 2 billions sperms per day.
- The lifetime of a single sperm inside the female vagina ranges from 2 to 6 hours, this period can extend to reach up to 3 days if the sperm managed to break through the cervix and enters the uterus where it feeds on uterine secretions.

TRY

TO ANSWER worksheet  
in the Notebook

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4

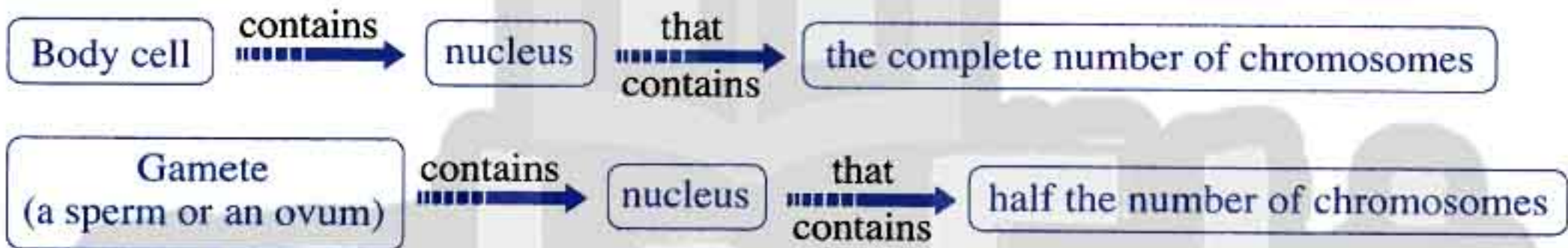
**Fertilization and embryo formation :**

Fertilization process can be defined as :

**Fertilization :**

It is the fusion of the nucleus of male gamete (sperm) with the nucleus of female gamete (ovum) to form the zygote (fertilized ovum).

1. - You know that the body of a living organism consists of cells, each cell contains a nucleus that contains the complete number of chromosomes (genetic material) of the species.  
- Chromosomes carry genes, which are responsible for the hereditary traits of the species.
2. The ovum and sperm differ from any other body cells in the number of chromosomes in the nucleus, where the nucleus of a sperm or an ovum contains only half number of chromosomes.

**NB**

In human, the nucleus of the body cell contains 46 chromosomes, while the nucleus of a sperm or an ovum contains 23 chromosomes.

**How does the fertilization process take place ?**

1

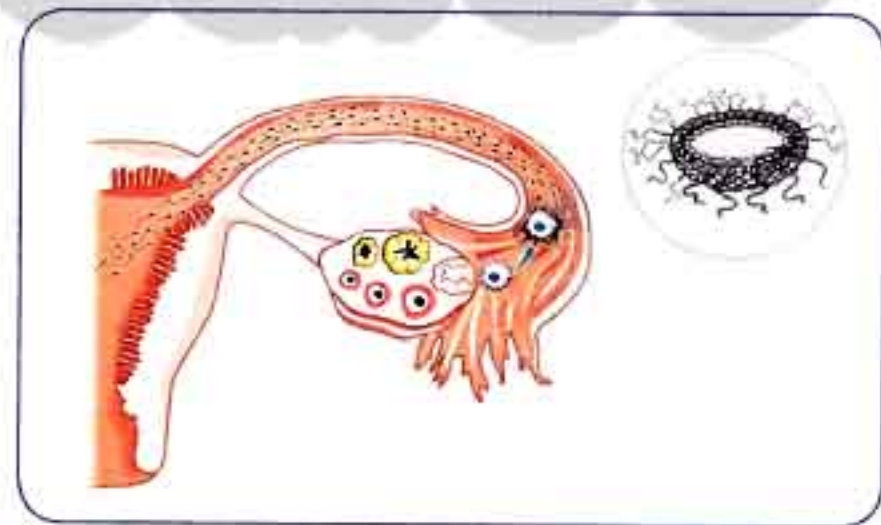
The female produces only one ovum on the 14<sup>th</sup> day of the beginning of menstrual cycle.

2

During mating, the male secretes billions of sperms, which move from the vagina towards the uterus then to fallopian tube.

3


The sperms rush the ovum at the beginning of fallopian tube.



The transference of the sperms to the ovum through fallopian tube



UNIT  
3

- The head of the sperm secretes enzymes 

4

To dissolve the cellular membrane of the ovum and facilitate its penetration inside the ovum.

- One sperm only can penetrate the cellular membrane of the ovum.

5

After the penetration of the sperm, the ovum surrounds itself with a membrane that prevents the penetration of any other sperm.

6

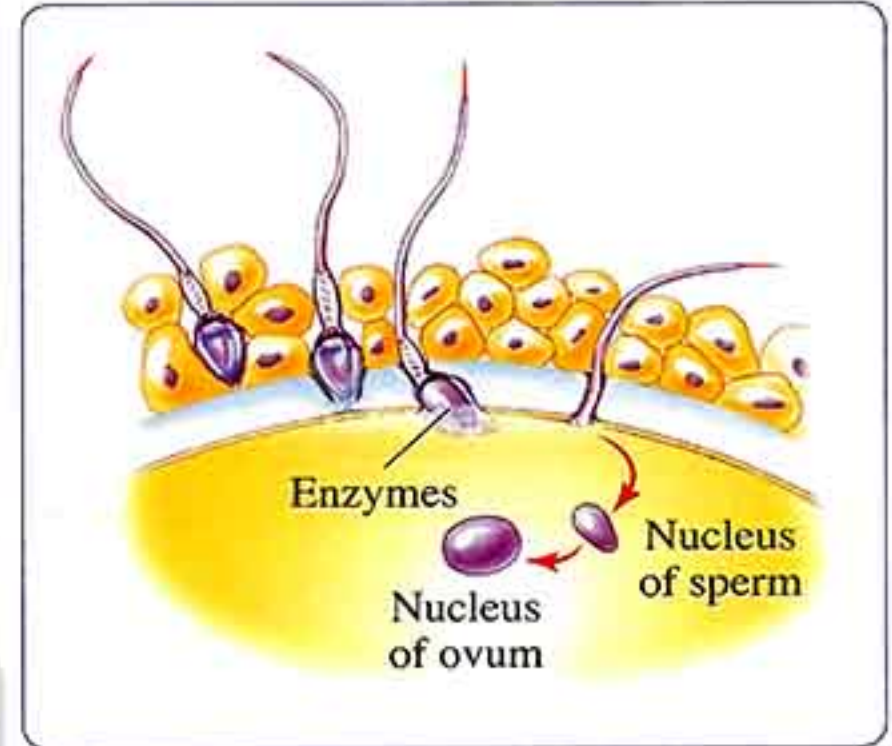
The nucleus of sperm (which contains 23 chromosomes) fuses with the nucleus of the ovum (which contains 23 chromosomes) to form the **zygote** (fertilized ovum), that contains a nucleus with 46 chromosomes (23 pairs of chromosomes).

7

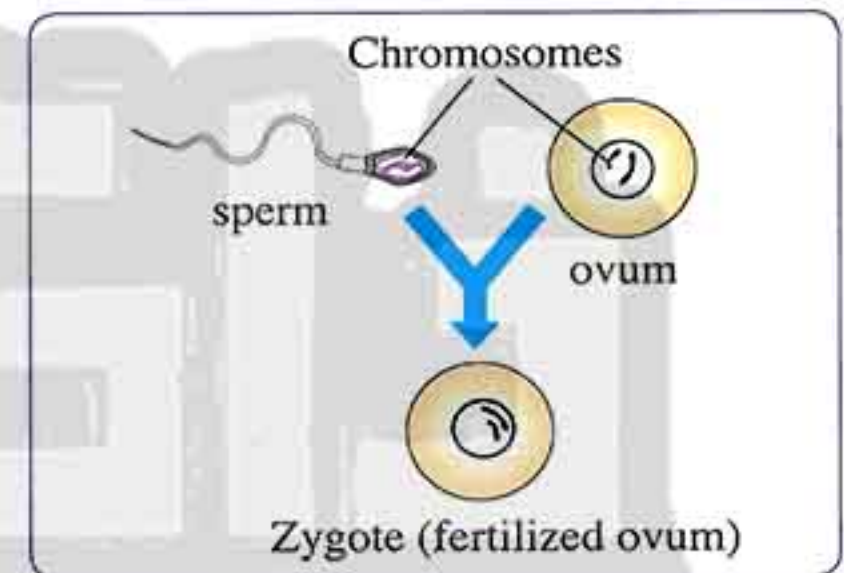
The zygote transfers to the uterus to be implanted in its lining.

8

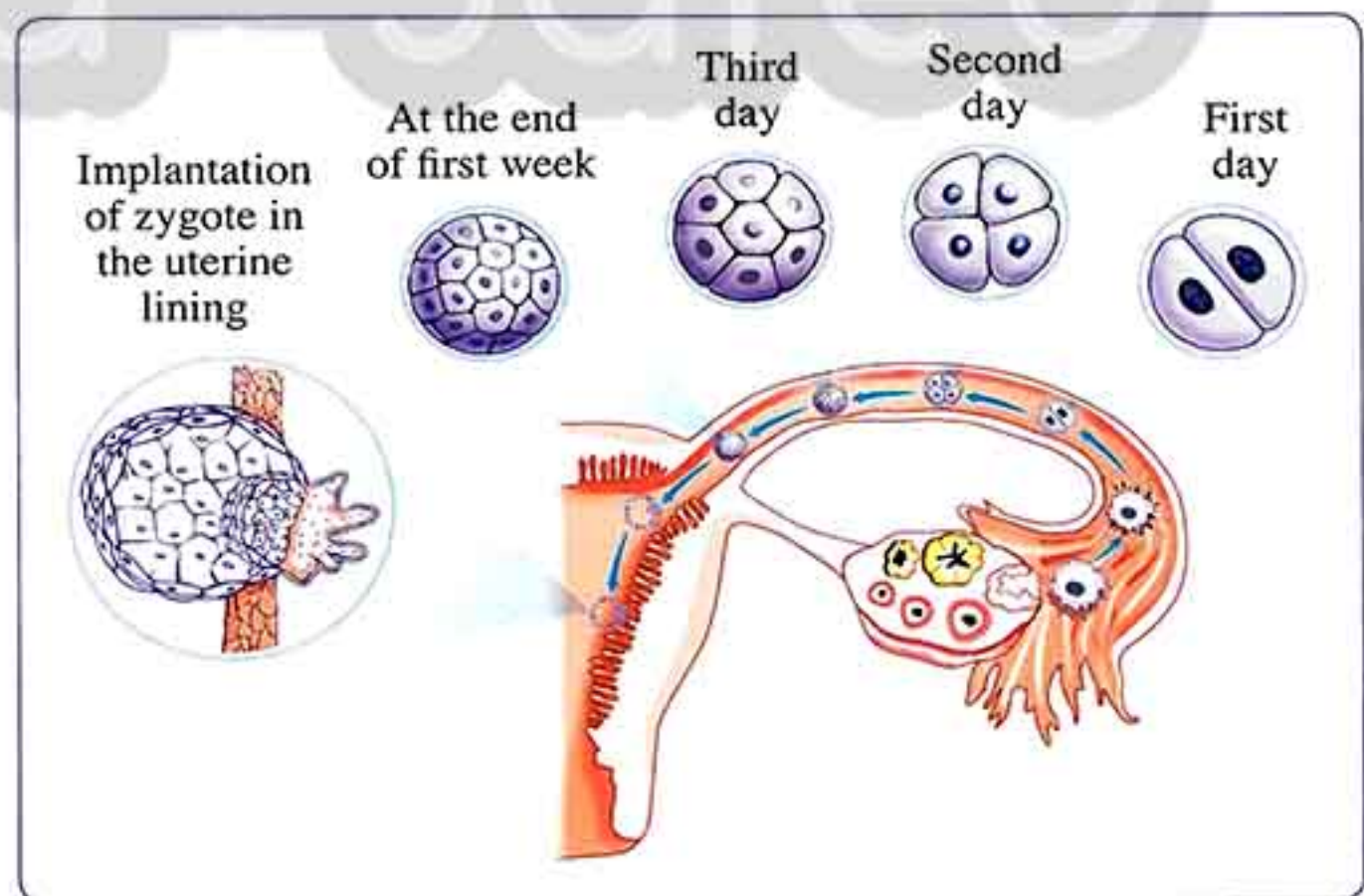
The zygote divides many successive divisions into many cells that differentiate and continue to grow forming the **embryo** (fetus).



Steps of fertilization



The formation of zygote



The formation of embryo



- The period between fertilization and delivery is known as the **pregnancy period**, which extends for about **9 months**.

NB

The new born baby will carry the genetic traits of his parents [as his cells contain 23 chromosomes coming from his mother (ovum) and 23 chromosomes coming from his father (sperm)].

GR.

**The nucleus of male sexual cell contains one half of the genetic (hereditary) substance.**

Because during fertilization, it combines with the ovum (egg cell), which contains one half of the hereditary substance to form the zygote, which contains the complete hereditary substance of the species.

#### ► Enrichment information

*In case of failure in fertilization, the endometrium falls down and the blood capillaries detach causing blood to flow out of the vagina for 4 to 5 days in a process known as the menstruation.*

- From the previous study, we can compare between plant gametes and human gametes :

| Kind of organism | Reproductive organ | Gametes | Characteristics of gametes |
|------------------|--------------------|---------|----------------------------|
| Male             | Animals            | Testis  | Sperms                     |
|                  | Plants             | Anther  | Pollen grains              |
| Female           | Animals            | Ovary   | Ova (egg cells)            |
|                  | Plants             |         |                            |

- small in size.
- produced in large numbers.
- mobile.
- each one of them contains half the number of chromosomes that are found in a male (father) body cells.
- large in size because it stores nutrients.
- produced in few numbers.
- not mobile (static).
- each one of them contains half the number of chromosomes that are found in a female (mother) body cells.



**Genital system diseases :**

Diseases of genital system in male and female are classified into two types, which are :

**First type**

Diseases don't arise from sexual contact.

**Examples :**

Uterine cancer, prostate cancer and puerperal sepsis (childbed fever).

**Second type**

Diseases arise from sexual contact (sexually transmitted diseases "STDs").

**Examples :**

Gonorrhea, syphilis and AIDS.


**Incubation period :**

It is the period between the beginning of infection and the appearance of symptoms of the disease.

➔ **Now, we will study puerperal sepsis as an example of the first type, and syphilis as an example of the second type.**

1

**Puerperal fever (sepsis) :**

|   |  |   |
|---|--|---|
| <b>The microbe, that causes the disease :</b> | Spherical-shaped bacteria.   |  |
| <b>Methods of infection :</b>                 | 1. By droplets from a person infected with bacteria and suffering from throat infection or tonsillitis to a vagina of recently laboured mother.<br>2. An infected wound during the labour.   | Spherical bacteria  |
| <b>Incubation period :</b>                    | From one to four days.   |   |
| <b>Symptoms :</b>                             | 1. High elevation in body temperature.<br>2. Chills.<br>3. Pallor (face paling).<br>4. Severe acute pain in lower abdomen.<br>5. Bad smelling secretions from the uterus.  |   |
| <b>Means of protection (prophylaxis) :</b>    | 1. Sterilizing the surgical tools.<br>2. Wearing masks during labour (delivery).<br>3. Preventing visits of persons, who suffer from respiratory diseases to the mother after delivery.<br>4. The mother should be kept warm and avoid the exposure to air currents. |   |





## Lesson Two

## ► Enrichment information

*The bacteria causing puerperal sepsis can be transferred to the patient by her own throat secretions, that is why a pregnant woman suffering any respiratory disease should be treated first before delivery especially in the last two months to avoid autoinfection.*

2

## Syphilis :

|   |  |   |
|---|--|---|
| <b>The microbe, that causes the disease :</b> | Spiral-shaped bacteria.  |   |
| <b>Methods of infection :</b>                 | 1. Sexual contact with an infected person or a carrier.<br>2. From a pregnant woman to her fetus (through the umbilical cord or during the delivery).  |   |
| <b>Incubation period :</b>                    | From two to three weeks.   |   |
| <b>Symptoms :</b>                             | 1. Appearance of painless hard ulcer on the head of penis (in male) and in the vagina and the upper part of cervix (in female).<br>2. Appearance of dark brass coloured rashes on the back and hands of the patient.   |  |
| <b>Complications :</b>                        | If the patient is not treated as soon as the appearance of symptoms, this leads to :<br>- The appearance of tumors in different body parts like : the liver, bones and parts of genital system.<br>- The brain may also be damaged and the patient will die. | The hand of a patient of syphilis   |
| <b>Treatment :</b>                            | Syphilis can be treated in all symptoms stages.  |   |
| <b>Means of protection (prophylaxis) :</b>    | 1. Preventing the sexual contact with an infected person (preventing the illegal contacts).<br>2. Induce abortion of the infected pregnant woman.  |   |



UNIT  
3

## ➔ The effect of smoking and addiction on the genital system :

The studies showed that there are many bad effects of smoking on the reproductive health of males and females :

## 1. In males :

Decreases the formation of male sex hormone.

## 2. In females :

## A In non-pregnant woman :

Decreases the formation of female sex hormones.

## B In pregnant woman :

(1) Leads to the increase in deformation rate in the embryos.

(2) Leads to the death of the embryos and newly born babies.



## Real Life application : Healthy toilet seat cover :

A plastic medical cover in the form of an elliptical plastic frame sold in pharmacies is to be used in public toilets to avoid infection by some skin and genital diseases.



Healthy toilet seat cover

## TRY

## TO ANSWER worksheet

19

• General Exercise of the School Book on Unit 3

• Model Exams on Unit 3

in the Notebook





# Remember



## ★ Signs of puberty in male :

1. Growth of hair in certain body areas (like beard and mustache).
2. Harshness of voice.
3. Development of genital organs.
4. Growth of bones.
5. Enlargement of muscles.

There are three kinds of genital glands connected to the male reproductive system which are :

1. Two seminal vesicles.
2. Prostate gland.
3. Two Cowper's glands.

## ★ Function of genital glands :

They secrete a seminal fluid (alkaline fluid) which :

1. Nourishes (feeds) the sperms (as it contains nutrients).
2. Facilitates the flow of sperms.
3. Neutralizes the acidity of urethra (so sperms don't die during passing through urethra).

## ★ Signs of puberty in female :

1. Growth of hair in armpit and pubic.
2. Softness of voice.
3. Growth and development of breasts.
4. Accumulation of fats in some body regions.
5. Occurrence of menstrual cycle every 28 days, as long as no pregnancy happens.

## ★ Fertilization :

It is the fusion of the nucleus of male gamete (sperm) with the nucleus of female gamete (ovum) to form the zygote (fertilized ovum).

## ★ Incubation period :

It is the period between the beginning of infection and the appearance of symptoms of the disease.

## ★ The effect of smoking and addiction on the genital system :

### 1. In males :

Decreases the formation of male sex hormone.

### 2. In females :

#### A In non-pregnant woman :

Decreases the formation of female sex hormones.


#### B In pregnant woman :

- (1) Leads to the increase in deformation rate in the embryos.
- (2) Leads to the death of the embryos and newly born babies.




# Questions

## on lesson two



Questions signed by  have been taken from the school book.

### 1. Choose the correct answer :

- All of the following are organs of the male reproductive system except .....  
a. vas deferens.      b. uterus.      c. testes.      d. penis.
- The temperature of the two testes must be ..... the normal body temperature.  
a. two degrees below      b. two degrees above  
c. the same as      d. higher than
- Male puberty features are related to the effect of ..... hormone.  
a. estrogen      b. thyroxin      c. testosterone      d. progesterone
- ..... is from the signs of puberty in male.  
a. Softness of voice      b. Development of breasts  
c. Harshness of voice      d. Occurrence of menstrual cycle
- Sperms transfer from the testes to the urinary genital duct through .....  
a. urethra.      b. epididymis.      c. vas deferens.      d. penis.
- Sperms are stored in the .....  
a. epididymis.      b. vas deferens.      c. urethra.      d. prostate gland.
- The seminal fluid is ..... in nature.  
a. an acidic      b. a neutral      c. an alkaline      d. no correct answer
- All of the following are functions of seminal fluid except .....  
a. it facilitates the mobility of sperms.      b. feeding sperms.  
c. keeping the temperature of testes.      d. neutralization of the acidity of urethra.
- The ..... has the size and shape of a peeled almond.  
a. testis      b. uterus      c. ovary      d. sperm
-  The right ovary in the female human produces a mature (ripe) ovum every ..... days.  
a. 24      b. 28      c. 34      d. 56
- ..... hormone is responsible for the continuity of pregnancy.  
a. Estrogen      b. Testosterone      c. Progesterone      d. Thyroxin
- The fallopian tubes are .....  
a. of funnel-shaped opening.      b. lined with cilia.  
c. open in the upper corners of uterus.      d. (a) , (b) , (c) are correct.
- The ..... nourishes the embryo during the pregnancy period.  
a. ovary      b. placenta      c. spinal cord      d. no correct answer
- The ..... is a muscular tube that expands during the labour.  
a. fallopian tube      b. vagina      c. ovary      d. uterus



## Lesson Two

15. The ovum stores food and nutrients in the .....  
 a. nucleus. b. cytoplasm.  
 c. cellular membrane. d. no correct answer.
16. The ..... of a sperm contains mitochondria.  
 a. head b. midpiece c. tail d. nucleus
17. The female produces only one ovum in the ..... of the menstrual cycle.  
 a. 7<sup>th</sup> day b. 12<sup>th</sup> day c. 14<sup>th</sup> day d. 16<sup>th</sup> day
18. In human, fertilization process takes place in the .....  
 a. vagina. b. fallopian tube. c. uterus. d. cervix.
19.  Fertilization occurs when ..... is formed.  
 a. embryo b. zygote c. endometrium d. ovum
20. In man, the zygote contains .....  
 a. 23 chromosomes. b. 32 pairs of chromosomes.  
 c. 32 chromosomes. d. 23 pairs of chromosomes.
21. The fertilized egg is implanted in the lining of the .....  
 a. uterus. b. vagina. c. cervix. d. fallopian tube.
22. In human, the period between fertilization and delivery is about ..... months.  
 a. 7 b. 8 c. 9 d. 10
23. All of the following are sexual transmitted diseases except .....  
 a. gonorrhea. b. syphilis. c. prostate cancer. d. AIDS.
24. The incubation period of puerperal sepsis disease ranges from .....  
 a. 1 to 4 days. b. 2 to 6 days. c. 1 to 4 weeks. d. 2 to 3 weeks.
25. All of the following are symptoms of puerperal sepsis disease except .....  
 a. high body temperature. b. headache.  
 c. face paling. d. chilling.
26. The microbe that causes the syphilis is .....  
 a. spiral virus. b. spherical bacteria.  
 c. spiral bacteria. d. spiral algae.
27. The incubation period of syphilis disease ranges from .....  
 a. 1 to 4 days. b. 1 to 4 weeks. c. 2 to 3 days. d. 2 to 3 weeks.
28.  An ulcer at the tip of the penis in male is due to ..... infection.  
 a. syphilis b. gonorrhea c. puerperal sepsis d. german measles





UNIT  
3

2. Choose from column (B), what is suitable for column (A) :

| (A)                | (B)   |
|--------------------|---|
| 1. Testes          | a. the embryo grows and develops inside it. |
| 2. Ovary           | b. fine convoluted tubes that store sperms. |
| 3. Epididymis      | c. muscular tube expands during labour.     |
| 4. Fallopian tubes | d. produce sperms and male sex hormone.     |
| 5. Uterus          | e. transfers sperms from testes to urethra. |
|                    | f. receives the female gamete.              |
|                    | g. produces the ovum.                       |

3. Put (✓) or (✗) then correct what is wrong :


1. Man can't reproduce asexually. ( )
2. The offspring coming from asexual reproduction are different from their parents. ( )
3. Production of sperms and male sex hormone is the function of prostate gland. ( )
4. The temperature of testes is 4°C above the normal body temperature. ( )
5. Sperms transfer from testes to urethra through the epididymis. ( )
6. The sperm's nucleus contains half the number of chromosomes. ( )
7. In human female, the two ovaries locate in the lower part of the pelvic cavity from the back. ( )
8.  The human female's ovule is a settled sphere shaped cell. ( )
9. The female puberty features are related to the effect of estrogen hormone. ( )
10. The left ovary releases one ripe ovum every 28 days. ( )
11.  The progesterone enzyme is responsible for pregnancy to continue. ( )
12. Growth of hair in armpit, harshness of voice, growth and development of breasts are from sings of female puberty. ( )
13. The age of menopause in female ranges between 11 to 14 years. ( )
14. Fallopian tubes open in the lower corners of the uterus. ( )
15. The uterus is a hollow pear-shaped organ with a muscular wall. ( )
16. The cervix connects the ovary with the uterus. ( )
17. The vagina is a muscular tube that expands during the pregnancy. ( )
18. The ovum is a mobile cell of a relatively large size. ( )
19. Sperms move from vagina to fallopian tubes through the uterus. ( )
20. The human female ovary produces only one ripe ovum on the 28<sup>th</sup> day of the beginning of the menstrual cycle. ( )
21. The sperm secretes hormones to dissolve the cellular membrane of the ovum. ( )
22. The fertilized ovum contains the complete number of chromosomes. ( )



## Lesson Two

23. After fertilization, the zygote transfers to the vagina to be implanted in its lining. ( )
24. The period between fertilization and delivery is known as the incubation period. ( )
25. The pregnancy period in human beings takes 28 weeks. ( )
26. Uterine cancer is a genital disease which doesn't arise from sexual contact. ( )
27. Puerperal sepsis disease can infect both male and female. ( )
28. The incubation period of puerperal sepsis disease ranges from 1 to 4 weeks. ( )
29. Bad smelling secretions from the uterus is from the symptoms of syphilis disease. ( )
30. Syphilis disease is caused by spiral bacteria. ( )
31. Syphilis disease can be transmitted by inhalation. ( )
32. The incubation period of syphilis ranges between 1 to 2 weeks. ( )
33. Appearance of tumors in liver, bones and parts of genital organ are from the symptoms of syphilis disease. ( )

#### 4. Write the scientific term :

1. A process by which the living organisms are protected from extinction.
2. The type of reproduction in human beings.
3.  An oval-shaped gland that produces male gametes.
4. A sac-like structure that regulates and keeps the temperature of testes 2°C below the normal body temperature.
5. Group of glands, their function is to secrete semen.
6. The male sex hormone which is responsible for the appearance of secondary male sex characters.
7. A group of fine convoluted tubes connected to the testes.
8. It transfers the sperms from the testes to the urethra.
9. A fluid secreted by male genital associated glands.
10. A male reproductive organ through which urine and seminal fluid pass outside the body.
11. • Two glands that produce the female gametes in human females.
  - The female reproductive organ, which secretes the female sex hormones.
12. The female sex hormone, which is responsible for the appearance of secondary female sex characters.
13. The female sex hormone, which is responsible for the continuity of pregnancy.
14. The process of producing ova from the ovaries mutually every 28 days.
15. A phenomenon happens in female every 28 days at the age of puberty.
16. A tube with a funnel-shaped opening transport the ovum to the uterus.
17. • A hollow pear-shaped female sex organ with a muscular wall.
  - A female sex organ, which locates in the abdominal cavity between the urinary bladder and the rectum.
  - A female reproductive organ in, which the fetus is protected and feed till birth.



UNIT  
3



18. The female gamete.
19. The male gamete.
20. A part of the ovum, which contains the genetic material.
21. A part of the ovum stores food and nutrients.
22. A part of the sperm, which contains the genetic material.
23. A part of the sperm, which contains mitochondria.
24. A part of the sperm, which is responsible for its movement.
25. The genetic material in the cell.
26. The fusion of the nucleus of male gamete with the nucleus of female gamete to form the zygote.
27. The period between fertilization and delivery.
28. A structure, which is formed as a result of successive divisions of zygote.
29. • A genital disease, which is caused by spherical-shaped bacteria.  
• A genital disease, which infects a recently labored mother.  
• A genital disease from its symptoms high elevation in body temperature, face paling and bad smelling secretions from the uterus.
30. The period between the beginning of infection and the appearance of disease symptoms.
31. • A genital disease caused by spiral bacteria.  
• A disease, whose symptoms appear as a rash on the reproductive organ.

**5. Complete the following statements :**

1. Reproduction aims to secure the existence and continuity of living organisms ..... and to prevent them from .....
2. The human male reproductive system consists of ....., two vas deferens, ..... and penis.
3. The two testes locate ..... the body in a structure called .....
4. The testis function is to produce ..... and secrete the ..... hormone.
5. .... is the male sex hormone, which is responsible for the appearance of .....
6. Growth of hair in certain body areas, ..... of voice and development of ..... are from the signs of ..... in male.
7. The scrotal sac keeps the temperature of testes ..... degrees below the normal body temperature, which is the optimum temperature for the growth and development of .....
8. In the reproductive system of the human male, each testis is attached to highly looped tubes known as .....
9. The final stages of the growth and development of sperms take place in .....
10. Vas deferens transports ..... from ..... to ..... duct.
11. 📖 ..... glands and ..... gland are from glands associated with the male genital system.
12. The seminal fluid ..... the acidity of the .....
13. The female reproductive system consists of ....., ....., ..... and vagina.



## Lesson Two



14. The ..... is a female reproductive organ, that has the shape and size of a peeled .....
15. The two ovaries locate inside the body in the lower part of the ..... cavity from the .....
16. Each ovary releases one ripe ..... every ..... days in exchange with the other ovary in a process called .....
17. .... and ..... are female sex hormones.
18.  The ..... hormone in males and ..... hormone in females are responsible for the appearance of secondary sex characters.
19. From the signs of puberty in female is the occurrence of ..... every ..... days.
20. Fallopian tubes are tubes of ..... -shaped opening provided with finger-like projections to receive the ripe .....
21. The inner wall of fallopian tubes is lined with ..... to direct the ovum towards the .....
22. The two fallopian tubes are open in the ..... corners of the .....
23. The ..... is a hollow pear-shaped female sex organ that has a ..... wall.
24. The ..... extends from the uterus and ends in external genital opening.
25. The vagina is a ..... tube that expands during the .....
26. The ovum consists of ..... , cytoplasm and .....
27.  The sperm consists of ..... , midpiece and .....
28. The midpiece of the sperm contains ..... responsible for energy production needed for the sperm .....
29. Chromosomes carry ..... , which are responsible for the ..... of the species.
30. .... is the fusion of a sperm nucleus with an ovum nucleus to form the .....
31. During fertilization process, the sperm secretes ..... , which dissolve the ..... of ovum to facilitate its penetration inside the ovum.
32. Each cell of the zygote of human carries ..... chromosome.
33. The fertilized ovum is called .....
34. .... and ..... are examples of genital diseases which don't arise from sexual contact.
35. The infection with syphilis and ..... is caused by .....
36. The puerperal sepsis disease is caused by ..... bacteria, while syphilis disease is caused by ..... bacteria.
37. The incubation period of puerperal sepsis disease is ..... , while that of syphilis disease is .....
38. Syphilis disease can be transmitted from pregnant woman to her fetus through the ..... or during the .....
39. From the complications of syphilis disease is the appearance of ..... in different body parts like ..... and bones.




## UNIT

## 3

**6. Give reasons for :**

1.  Man can't reproduce asexually.
2. The presence of testes outside the body in a sac-like structure called the scrotal sac.
3. Appearance of secondary male sex characters.
4.  The man, whose testicles are still present inside the abdominal cavity is infertile (sterile).
5. The seminal fluid is alkaline in nature.
6. The seminal fluid contains nutrients.
7. The right ovary produces one ripe ovum every 56 days.
8. Appearance of secondary female sex characters in human.
9. Fallopian tubes are of funnel-shaped opening provided with finger-like projections.
10. The inner wall of fallopian tubes is lined with cilia.
11. The uterus has a muscular wall.
12. The uterus is lined with mucus membrane rich in blood capillaries.
13. The uterus is a suitable organ for the growth of embryo.
14. The midpiece of the sperm contains mitochondria.
15. The sperm has a long and thin tail.
16. The ovum is relatively large in size.
17. During fertilization, the head of sperm secretes enzymes on the ovum.
18. Fallopian tubes ligation is considered one of the means of birth control.
19. The ovum surrounds itself with a coat after the penetration of a sperm inside it.
20. The nucleus of a sperm or an ovum contains half the hereditary material.
21. Zygote undergoes several successive divisions.
22. The new born baby will carry the genetic traits of his parents.
23. • A new laboured mother should avoid air currents after delivery.
  - It is necessary to wear masks during labour process.
  - Preventing visits of persons who suffer from respiratory diseases to the mother after delivery.

**7. What is meant by ... ?**

1. The age of menopause of females.
2. Ovulation process.
3. Fertilization process.
4. Genes.
5.  The sperm carries half of the genetic material of the species.
6. The pregnancy period.
7. Incubation period.

**8. Mention the function or importance of each of the following :**

1. Reproduction process.
2. The two testes.
3. Testosterone hormone.
4. The scrotal sac.



5. The vas deferens.
6. The epididymis.
7. Genital associated glands in male.
8. Seminal fluid.
9. The two ovaries.
10. Estrogen and progesterone hormones.
11. Fallopian tubes.
12. The placenta.
13. The uterus.
14. The nucleus of the ovum.
15. The cytoplasm in the ovum.
16. The cellular membrane of the ovum.
17. The head of a sperm.
18. The midpiece of a sperm.
19. The tail of a sperm.
20. Genes.

**9. Extract the unsuitable word or statement, then write the relation between the rest :**

1. Testes / Fallopian tubes / Vas deferens / Scrotum.
2. Thyroid gland / Prostate gland / Cowper's gland / Seminal vesicles.
3. Ovary / Epididymis / Uterus / Vagina / Cervix.
4. Head / Tail / Midpiece / Cytoplasm.
5. Development of breasts / Harshness of voice / Menstrual cycle / Growth of hair in armpit and pubic.
6. AIDS / Gonorrhea / Syphilis / Measles.
7. Vomiting / High body temperature / Chilling / Face paling.

**10. What happens when ... ?**

1. The two testes present inside the body and don't come out during the embryo development.
2. The seminal fluid is not alkaline in nature.
3. The ovary is unable to secrete estrogen hormone.
4. The ovary is unable to secrete progesterone hormone.
5. The fallopian tubes are not ciliated and have no muscular wall.
6. The mucus membrane lining the uterus has no blood capillaries.
7. The midpiece of a sperm is damaged.
8. The sperm has no tail.
9. The fallopian tubes are ligated.
10. The sperm head is unable to secrete enzymes on the ovum.
11. The sperms are not mobile cells.
12. The ripe ovum is not fertilized.
13. • The wound of recently laboured mother is infected by spherical bacteria.  
• The recently laboured mother is subjected to air currents.
14. The syphilis infected person is not treated.



UNIT  
3

## 11. Compare between :

1. Testes and ovaries (related to : the position and function).
2. The sperm and the ovum (three points only).
3. Puerperal sepsis and syphilis (related to : microbe causing disease - methods of infection and incubation period).

## 12. Various questions :

## (1) Mention the signs of puberty in :

1. Males.
2. Females.

## (2) Write briefly the effect of smoking and addiction on the genital system.

## (3) Mention the symptoms of the following diseases and the methods of protection (prophylaxis) :

1. Puerperal sepsis.
2. Syphilis.

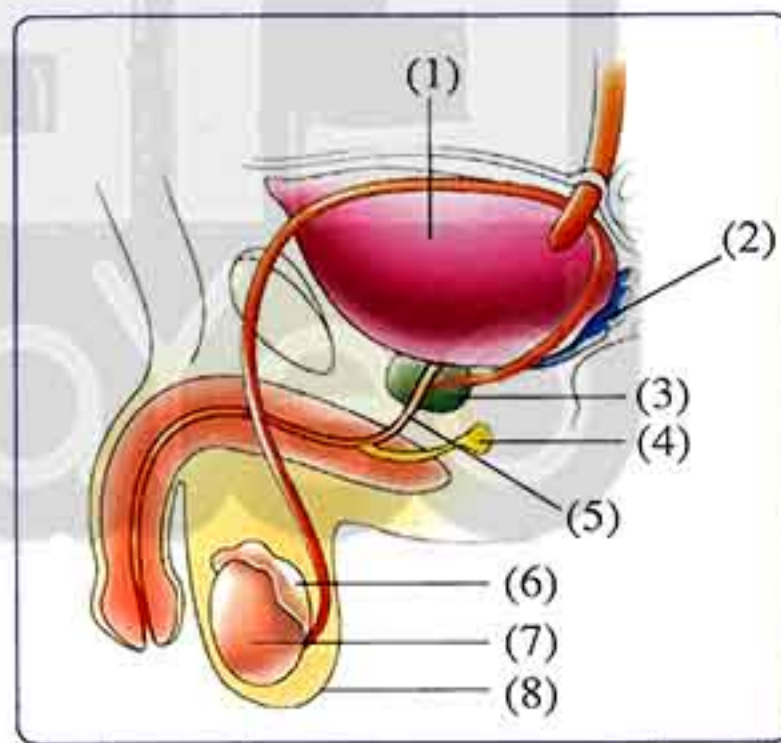
## (4) Draw an illustration showing the structure of :

1. The female human ovum.
2. The male human sperm.

## 13. Study the following figures, then answer the following :

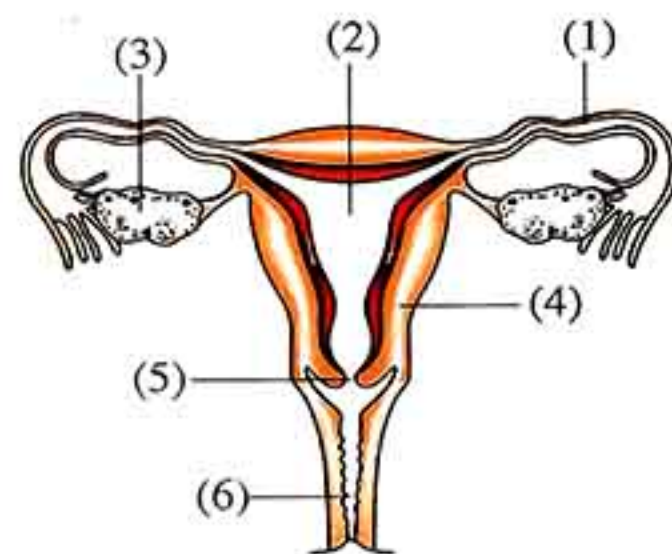
## (1) Study the opposite figure, then answer the following questions :

1. What is the name of this system ?
2. What does each number in the figure refer to ?
3. What is the function of parts (2), (3) and (4) ?
4. Name the part (vessel) that carries sperms to part number (5).
5. The organ (7) has two functions, mention them.
6. What happens if part (7) exists inside the body ?
7. What are the glands that open in part (5) ?



## (2) The opposite figure represents the female genital system, answer the following questions :

1. Replace the numbers present in the figure with suitable labels.
2. What is the organ in which :
  - a. Ova are produced ?
  - b. The ovum is fertilized ?
  - c. The embryo is delivered to life ?

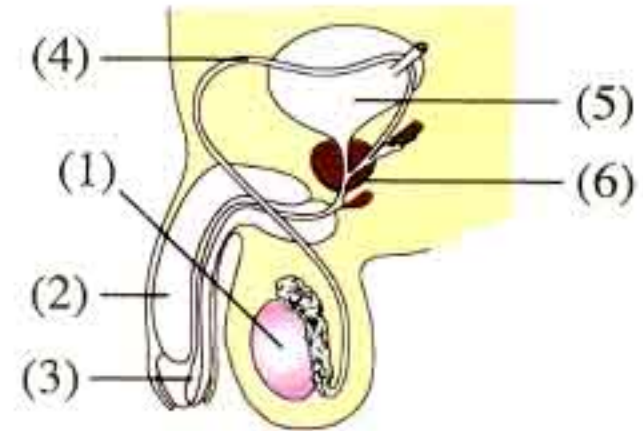




## Lesson Two

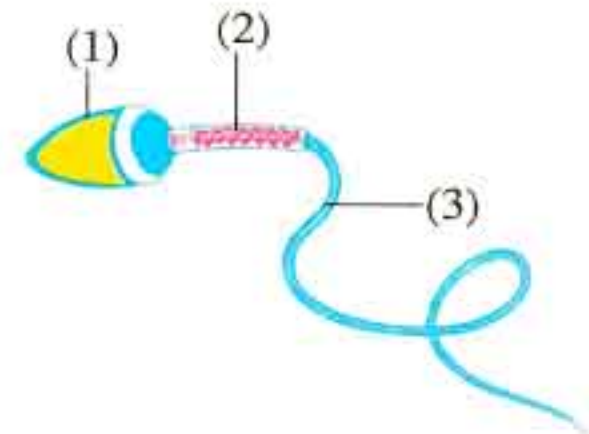
(3)  The opposite figure represents the male genital system, answer the following questions :

1. Replace the numbers with the suitable labels.
2. Write the number of the part, in which :
  - a. Sperms are produced.
  - b. Secretion of semen.
  - c. Transfer of sperms from the testes to the penis.



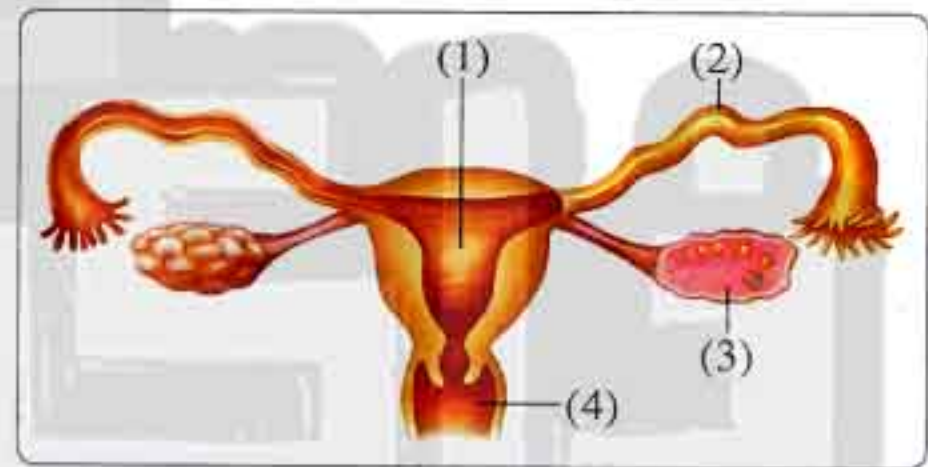
(4) Study the opposite figure, then answer the following :

1. What does the figure represent ?
2. Label the figure.
3. Mention the importance of parts (1) and (2).
4. How does part (1) penetrate the ovum ?



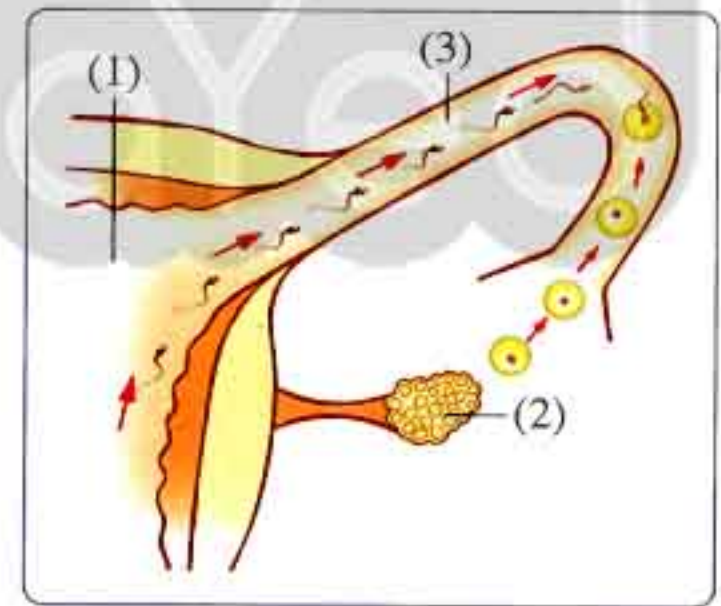
(5) The opposite figure represents one system in the human body, mention its name, then answer the following :

1. Label it from (1) to (4).
2. What is the character of part (2) to help a fertilized ovum to pass into part (1) ?
3. Part (3) has a secretion activity. Mention the products and explain their benefits.
4. What happens on ligation of part (2) ?

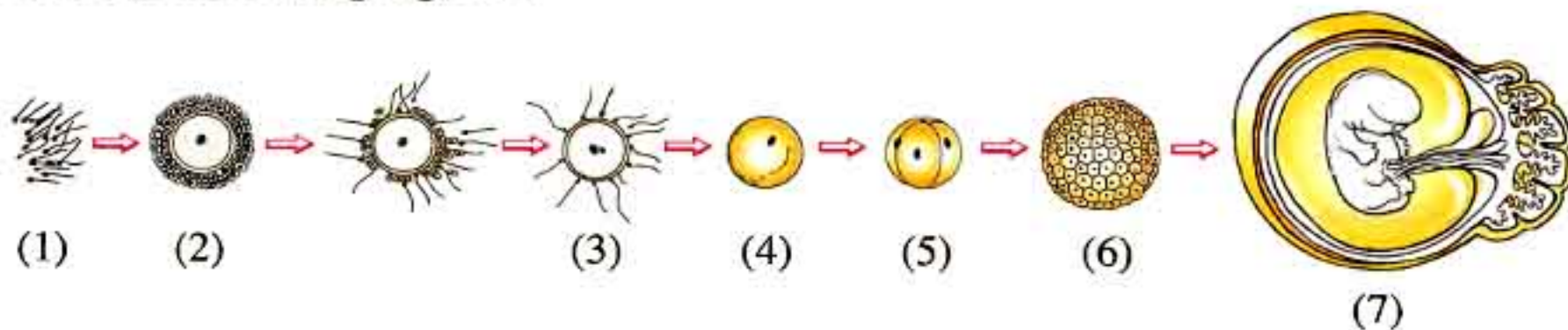


(6) The following figure is the left part of the human female reproductive system :

1. Write, what does each number indicate?
2. What is the function of the organ number (1) ?
3. Mention the process, which takes place in part (3).
4. The organ number (2) usually releases one ripe ovum every ..... days.
  - a. 14
  - b. 28
  - c. 42
  - d. 56



(7) From the following figure :





UNIT  
3

1. What is the process, which is referred by the structure (3) ? And what is the place of its occurrence ?
2. What is the number of chromosomes present in the cells (1) , (2) and in structure (7) ?
3. Complete :  
Structure (4) refers to ..... which is formed in the ..... but structure (7) refers to ..... which is formed in the .....

**(8) The opposite two figures show two kinds of bacteria, which cause two different diseases related to human reproductive system :**

1. Detect the shape of bacteria in each figure.
2. Mention the kind of disease, which is caused by each of them.
3. Mention the incubation period of the disease caused by the bacteria in fig. (A).
4. Mention the complications of the disease caused by the bacteria in fig. (B).

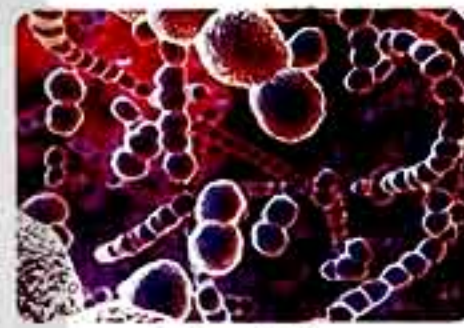


Fig. (A)



Fig. (B)



# Timss Questions



## 1. Choose the correct answer :

1. The adult female produces about ..... ova during 3 years.

- a. 12                      b. 13                      c. 36                      d. 39

2. The sperm joins the ovum to form genetic materials in a ratio .....

- a. 1 : 2                      b. 1 : 1                      c. 2 : 1                      d. 1 : 4

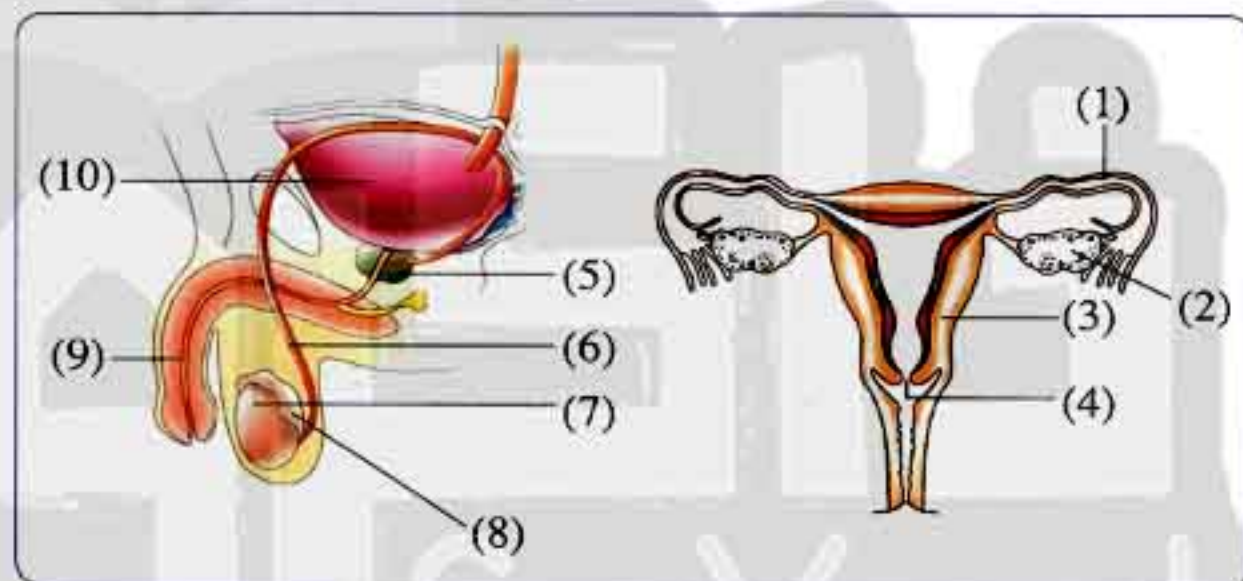
## 3. From the two opposite figures :

(A) Part number ..... and part number ..... have the same two functions in the sexual reproduction process.

- a. (1) , (6)                      b. (2) , (9)  
c. (3) , (5)                      d. (4) , (7)

(B) Part number (2) has the same function of part number ..... in the sexual reproduction process.

- a. (5)                      b. (7)  
c. (8)                      d. (10)



## 2. Put (✓) or (✗) , then correct what is wrong :

1. Sperms are completely matured when they are released from testes. ( )  
2. Fertilized ovum contains the same number of chromosomes as ripe ovum. ( )

## 3. Sperm contains 23 chromosomes. Give a reason.

## 4. What happens if an ovary produces testosterone hormone instead of estrogen hormone ?



# Glossary





## Glossary

## Unit 1

## Lesson 1

|                                  |                    |
|----------------------------------|--------------------|
| periodic motion                  | حركة دورية         |
| oscillatory (vibrational) motion | حركة اهتزازية      |
| transitional motion              | حركة انتقالية      |
| regularly repeated               | تتكرر بانتظام      |
| wave motion                      | حركة موجية         |
| simple pendulum                  | بندول بسيط         |
| original position                | مكان أصلي          |
| time intervals                   | فترات زمنية        |
| velocity (speed)                 | سرعة               |
| displacements                    | إزاحات             |
| maximum value                    | أعلى قيمة          |
| oscillating body                 | جسم مهتز           |
| kinetic energy                   | طاقة الوضع         |
| vanishes                         | تندعم              |
| tuning fork                      | شوكة رنانة         |
| spring                           | زنبرك              |
| stretched string                 | وتر مشدود          |
| motion of swing                  | حركة الأرجوحة      |
| rotary bee                       | النحلة الدوارة     |
| water molecules                  | جزيئات الماء       |
| graphical representation         | تمثيل بياني        |
| smooth paper tape                | شريط ورق أملس      |
| two rolls                        | بكرتين             |
| simple harmonic motion           | حركة توافقية بسيطة |
| amplitude                        | سعة الاهتزازة      |
| complete oscillation             | اهتزازة كاملة      |
| periodic time                    | زمن دوري           |
| frequency                        | تردد               |
| maximum displacement             | أعلى إزاحة         |
| measuring unit                   | وحدة قياس          |
| two successive times             | مرتين متتاليتين    |
| inverse relation                 | علاقة عكسية        |

## Lesson 2

|                    |                    |
|--------------------|--------------------|
| wave               | موجة               |
| concentric circles | دوائر متحدة المركز |
| transfer           | ينقل               |
| disturbance        | اضطراب             |

|                                |                      |
|--------------------------------|----------------------|
| propagate                      | تنتشر                |
| direction of waves propagation | اتجاه انتشار الأمواج |
| incense stick                  | عود بخور             |
| horizontally                   | أفقياً               |
| sound waves                    | موجات صوتية          |
| medium particles               | جزيئات الوسط         |
| certain moment                 | لحظة معينة           |
| definite direction             | اتجاه ثابت (موحد)    |
| line of wave propagation       | خط انتشار الموجة     |
| transverse waves               | أمواج مستعرضة        |
| longitudinal waves             | أمواج طولية          |
| mechanical waves               | أمواج ميكانيكية      |
| electromagnetic waves          | أمواج كهرومغناطيسية  |
| solar explosions               | الانفجارات الشمسية   |
| thunder                        | رعد                  |
| lightning                      | برق                  |
| vacuum (free space)            | فراغ                 |
| medium (pl. media)             | وسط (أوساط)          |
| perpendicular                  | عمودي                |
| crests                         | قمم                  |
| troughs                        | قيعان                |
| highest point                  | أعلى نقطة            |
| lowest point                   | أقل نقطة             |
| compressions                   | تضاغطات              |
| rarefactions                   | تخلخلات              |
| highest density                | أعلى كثافة           |
| lowest density                 | أقل كثافة            |
| equivalent to                  | مكافئ لـ             |
| sprians and cramps             | تشنجات عضلية         |
| nervous tension                | توتر عصبي            |
| wavelength                     | طول موجي             |
| wave velocity                  | سرعة الموجة          |
| wave frequency                 | تردد الموجة          |
| distance                       | مسافة                |
| sound velocity                 | سرعة الصوت           |
| directly proportional          | تناسب طردي           |
| waves propagation law          | قانون انتشار الأمواج |



## Glossary

## Unit 2

## Lesson 1

|                       |                       |
|-----------------------|-----------------------|
| properties            | خصائص                 |
| external factor       | عامل خارجي            |
| ear                   | أذن                   |
| sense of hearing      | حاسة السمع            |
| vibration of bodies   | أهتزاز الأجسام        |
| nature of sound waves | طبيعة الموجات الصوتية |
| different media       | أوساط مختلفة          |
| pleasant              | سار                   |
| irritation            | تهيج                  |
| source of fear        | مصدر للخوف            |
| musical tone          | نغمة موسيقية          |
| noise                 | ضوضاء                 |
| uniform frequency     | تردد منتظم            |
| non-uniform frequency | تردد غير منتظم        |
| drill                 | حفار                  |
| loudspeakers          | مكبرات صوت            |
| comfortable           | مريح                  |
| sound pitch           | درجة الصوت            |
| sound intensity       | شدة الصوت             |
| sound quality         | نوع الصوت             |
| rough (harsh)         | غليظ                  |
| sharp (soft)          | رفيع                  |
| segment               | جزء                   |
| length                | طول                   |
| air column            | عمود هواء             |
| Savart's wheel        | عجلة سافار            |
| gear's teeth          | أسنان الترس           |
| strong                | قوي                   |
| weak                  | ضعيف                  |
| cannon                | مدفع                  |
| rifle                 | بندقية                |
| noise intensity       | شدة الضوضاء           |
| vibrating surface     | سطح مهتز              |
| density of medium     | كثافة الوسط           |
| direction of wind     | اتجاه الرياح          |
| faint                 | يضعف                  |

## inverse square law of sound

قانون التربيع العكسي في الصوت

|                            |                     |
|----------------------------|---------------------|
| resonance box              | صندوق رنان          |
| vacuum pump                | مخلخلة هواء         |
| glass jar                  | ناقوس زجاجي         |
| ear plugs                  | سدادات الأذن        |
| fundamental tone           | نغمة أساسية         |
| harmonic tone              | نغمة توافقية        |
| accompany                  | مصاحبة              |
| audible sounds             | أصوات مسموعة        |
| non-audible sounds         | أصوات غير مسموعة    |
| sonic waves                | موجات سمعية         |
| ultrasonic waves           | موجات فوق سمعية     |
| infrasonic waves           | موجات تحت السمعية   |
| transmit                   | تنقل                |
| translate                  | تُترجم              |
| medical fields             | مجالات طبية         |
| industrial fields          | مجالات صناعية       |
| military fields            | مجالات حربية        |
| breaking                   | تفتيت               |
| kidney and ureter's stones | حصوات الكلى والحالب |
| surgical                   | جراحي               |
| operations                 | عمليات              |
| malignant tumors           | أورام سرطانية       |
| sterilize                  | تعقيم               |
| landmines                  | الألغام الأرضية     |

## Lesson 2

|                          |                       |
|--------------------------|-----------------------|
| sense of vision          | حاسة الإبصار          |
| nature of light waves    | طبيعة الموجات الضوئية |
| visible light            | ضوء مرئي              |
| electromagnetic spectrum | الطيف الكهرومغناطيسي  |
| light analysis           | تحليل الضوء           |
| light behaviour          | سلوك الضوء            |
| different media          | أوساط مختلفة          |
| straight lines           | خطوط مستقيمة          |
| spectrum colours         | ألوان الطيف           |
| glistening surface       | سطح لامع              |
| indigo                   | نيلى                  |
| violet                   | بنفسجي                |



## Glossary

## Unit 3

## Lesson 1

reproduction  
sexual reproduction  
flowering plants  
modified to  
floral bud  
axle  
whorls  
calyx  
sepal  
blooming  
corolla  
petal  
androecium  
stamen  
filament  
anther  
pollen grain  
gynoecium  
carpel  
stigma  
style  
ovary  
ovum (pl. ova)  
placenta  
receptacle  
pedicle  
typical flower  
Hay - fever  
bisexual (hermaphrodite) flower  
male flower  
female flower  
palm trees  
pollination  
fertilization  
self pollination  
mixed pollination  
hanged  
feathery-like  
sticky  
scented  
dissected  
artificial pollination

تكاثر  
تكاثر جنسي  
نباتات زهرية  
تحوّلت إلى  
برعم زهري  
محور  
محيطات زهرية  
الكأس  
سبلة  
تفتح  
التويج  
بتلة  
طلع  
سداة  
خيوط  
متك  
حبة لقاح  
متاع  
كريلة  
ميسم  
القلم  
مبيض  
بويضة/بويضات  
مشيمة  
تخت  
عنق  
زهرة غوذجية  
حصى القش  
زهرة خنثى  
زهرة مذكرة  
زهرة مؤنثة  
أشجار النخيل  
تلقيح  
إخصاب  
تلقيح ذاتي  
تلقيح خلطي  
مدلاة  
ريشية  
لزجة  
ذات رائحة ذكية  
متفتح  
تلقيح صناعي

triangular glass prism  
prism base  
prism apex  
quanta  
photons  
home decorations  
spot lights  
artifacts  
ornamented lamps  
stand lamps  
transparent medium  
translucent medium  
opaque medium  
permit  
thickness  
flint glass  
molasses  
light intensity (brightness)  
inverse square law of light

منشور ثلاثي زجاجي  
قاعدة المنشور  
رأس المنشور  
كمات  
فوتونات  
ديكورات منزلية  
كشافات ضوئية  
لوحات فنية  
مصابيح الزينة  
الأباجورات  
وسط شفاف  
وسط شبه شفاف  
وسط معتم  
سمّح  
سُمك  
زجاج مصنفر  
عسل أسود  
شدة الاستضاءة  
قانون التربيع العكسي في الضوء

## Lesson 3

light reflection  
light refraction  
shadow  
refract  
inverted images  
regular (uniform) reflection  
irregular (non-uniform) reflection  
recoil (return)  
leather  
light beam  
normal  
submarines  
events  
barrel  
optical density  
rectangular block  
angle of refraction  
angle of emergence  
facts  
absolute refractive index of the medium  
apparent position  
real position  
extensions  
mirage

انعكاس الضوء  
انكسار الضوء  
الظل  
ينكسر  
صور مقلوبة  
انعكاس منتظم  
انعكاس غير منتظم  
تردد  
جلد  
حزمة ضوئية  
عمود مقام  
غواصات  
أحداث  
برميل  
كثافة ضوئية  
متوازي مستطيلات  
زاوية الانكسار  
زاوية الخروج  
حقائق  
معامل الانكسار المطلق لمادة الوسط  
موضع ظاهري  
موضع حقيقي  
امتدادات  
السراب



## Glossary

generative  
germination  
micropyle  
zygote  
embryo  
degenerate  
asexual reproduction  
vegetative reproduction  
cut  
reproduction by cutting  
reproduction by grafting  
tissue culture

## Lesson 2

secure  
extinction  
mate  
male reproductive system  
testis (pl. testes)  
scrotal sac (scrotum)  
thighs  
puberty  
sperms  
optimum  
infertile (sterile)  
vas deferens  
convoluted tubes  
urinogenital duct (urethra)  
seminal fluid  
neutralize  
penis  
female reproductive system  
ovary  
peeled almond  
abdominal cavity  
cervix  
vagina  
fallopian tubes  
ripe = mature  
ovulation  
pregnancy  
armpit  
pubic  
breasts  
menstrual cycle  
menopause

مولدة  
إنبات  
نقير  
زيجوت  
جنين  
يتحلل  
تكاثر لاجنسي  
تكاثر خضري  
عُقله  
التكاثر بالتعقيل  
التكاثر بالتطعيم  
زراعة الأنسجة

ضمان  
الإنقراض  
يتزاوجا  
الجهاز التناسلي الذكري  
خصية  
كيس الصفن  
الفخذين  
البلوغ  
حيوانات منوية  
مناسبة  
عقيم  
الوعاء الناقل  
أنابيب ملتفة  
قناة بولية تناسلية  
سائل منوي  
يُعادِل  
القضيب  
الجهاز التناسلي الأنثوي  
مبيض  
اللوزة المقشورة  
التجويف البطنى  
عنق الرحم  
المهبل  
قناتا فالوب  
ناضجة  
تبويض  
حمل  
الإبط  
العانة  
الثديين  
الدورة الشهرية  
سن اليأس

projections  
cilia  
uterus  
pear-shaped  
hollow  
fetus  
blood capillaries  
placenta  
umbilical cord  
pelvic cavity  
urinary bladder  
labor = labour  
chromosomes  
genetic material  
hereditary traits  
fusion  
secrete  
secretions  
facilitate  
penetrate  
surround  
implanted  
successive divisions  
differentiate  
delivery  
genital system diseases  
sexual contact  
uterine cancer  
prostate cancer  
puerperal sepsis  
gonorrhea  
syphilis  
droplets  
infected  
throat  
tonsillitis  
high elevation  
chilling  
face paling  
sterilizing  
incubation period  
hard ulcer  
rash  
dark brass coloured  
tumors  
addiction

زوائد  
أهداب  
الرحم  
كمثرى - الشكل  
أجوف  
الجنين  
شعيرات دموية  
المشيمة  
الحبل السرى  
تجويف الحوض  
المثانة البولية  
وقت الطلق (الولادة)  
الكروموسومات  
مادة وراثية  
صفات وراثية  
اندماج  
يفرز  
إفرازات  
يُسَهِّل  
يخترق  
يحيط بـ  
تنغرس فـ  
انقسامات متتالية  
يتميز  
الولادة  
أمراض الجهاز التناسلي  
الاتصال الجنسي  
سرطان الرحم  
سرطان البروستاتا  
حمى النفاس  
السيلان  
الزهري  
رذاذ  
مُصاب  
الزور  
اللوزتين  
ارتفاع شديد  
قشعريرة  
شحوب فى الوجه  
تعقيم  
فترة الحضانه  
قرحة صلبة  
طفح  
لون نحاسى غامق  
أورام  
إدمان



PART

1

# Worksheets



## Worksheets on :

Unit One : Periodic Motion

Unit Two : Sound and Light.

Unit Three : Reproduction and Continuity of Species.



## UNIT ONE

## Lesson

## 1

## Oscillatory Motion

## Worksheet

## 1

## Question

## 1

Complete the following statements :

1. .... and .... are examples of periodic motion.
2. The oscillatory motion is the motion of the oscillating body around its ..... point and its velocity is ..... when it passes this point.
3. .... and .... are examples of the oscillatory motion.
4. The ..... motion is considered the simplest form of the oscillatory motion.
5. The kinetic energy =  $\frac{1}{2}$  .....  $\times$  .....

## Question

## 2

Give reasons for :

1. The motion of rotary bee is considered as a periodic motion.  
.....
2. The oscillation of the two branches of the tuning fork is an oscillatory motion.  
.....

## Question

## 3

Define :

1. Periodic motion.  
.....
2. Oscillatory motion.  
.....

## Question

## 4

Show by an activity the graphical representation of the oscillatory motion.

.....

.....

.....

.....

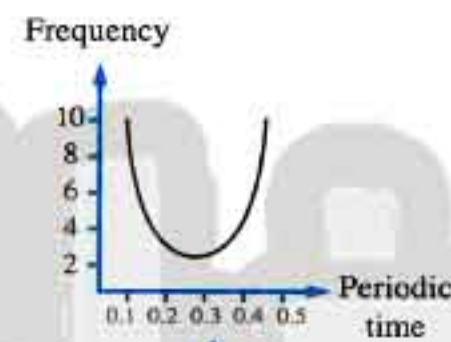
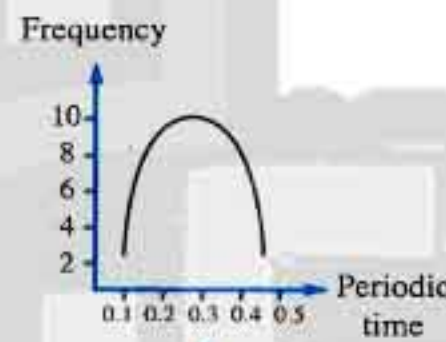
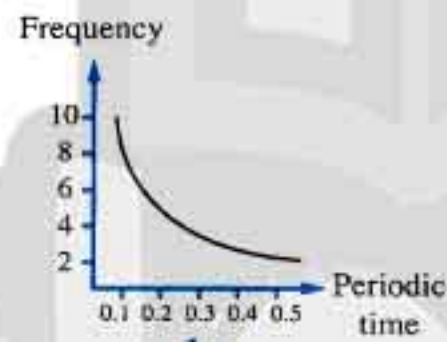
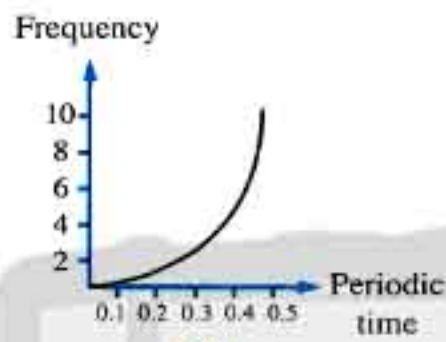


## Worksheet 2

## Question 1

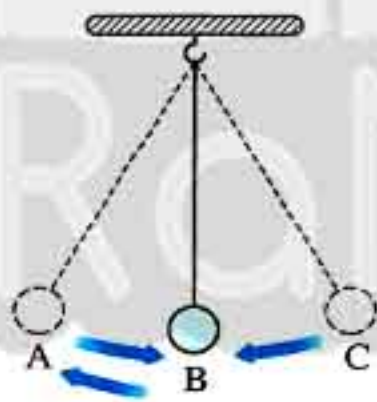
## A Choose the correct answer :

- The ..... includes four successive maximum displacements.  
a. amplitude      b. complete oscillation      c. wavelength      d. half complete oscillation
- If the frequency of an oscillating body is 100 Hz, so the periodic time is ..... seconds.  
a. 100      b. 0.01      c. 0.1      d.  $1 \times 10^2$
- Which figure represents the relation between the periodic time and the frequency ? .....



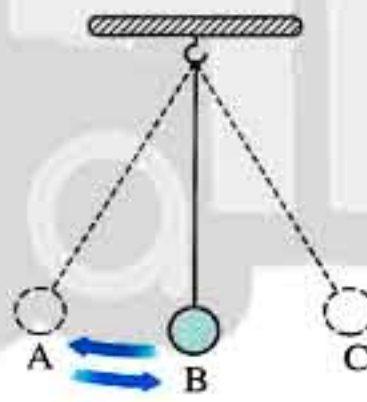
- Which figure represents a half complete oscillation ? .....

a.



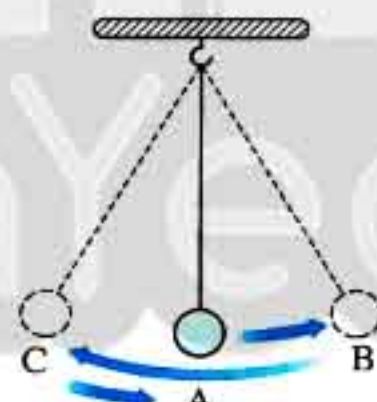
C → B → A → B

b.



B → A → B

c.



A → B → A → C → A

- The time taken by the vibrating body to make one complete oscillation is .....  
a. amplitude.      b. frequency.      c. periodic time.      d. complete oscillation.

## B From the opposite figure of the oscillatory motion of a simple pendulum, calculate :

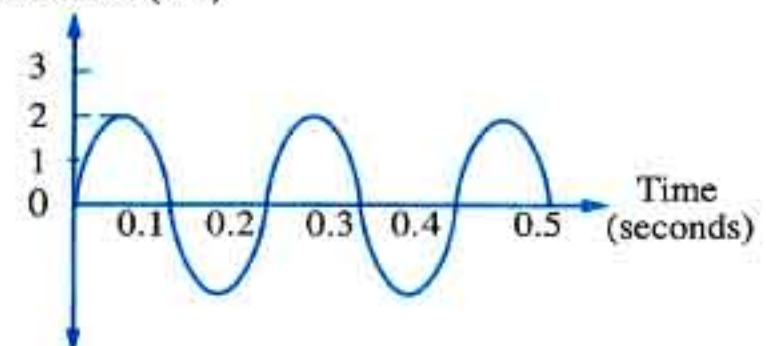
- Amplitude.
- Periodic time.
- Frequency.

.....

.....

.....

Displacement (cm.)





## PART

## 1

## Question 2

## A Put (✓) or (✗) :

1. Complete oscillation is the maximum displacement done by the oscillating body away from its rest position. ( )
2. The periodic time is the time taken by an oscillating body to make 4 successive maximum displacements away from its rest position. ( )
3. The oscillating body which its frequency is 50 Hz it takes 50 sec. to make one complete oscillation. ( )

## B What's meant by ...?

1. The amplitude of an oscillating body is 0.2 metre.  
.....
2. The frequency of a tuning fork is 652 Hz.  
.....
3. The time taken by the oscillating body to make 30 complete oscillations is 10 seconds.  
.....
4. The oscillating body makes 540 oscillations in one and a half minute.  
.....

## Question 3

## A Write the scientific term :

1. The reciprocal of the frequency. (.....)
2. The simplest form of the oscillatory motion. (.....)

## B Give a reason for :

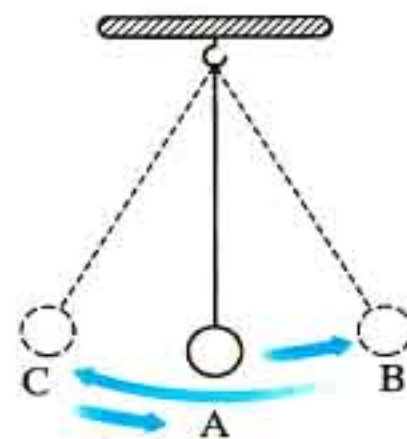
When the periodic time of a tuning fork increases, the number of complete oscillations which made by it in one second will decrease.

.....

## Question 4

Study the opposite figure, then answer the following questions :

1. Point (A) represents .....
2. The distance  $\overline{AB}$  represents ..... and it equals the distance .....
3. The vibrating body has its maximum kinetic energy at point(s) .....
4. When the pendulum makes 600 complete oscillations in two minutes, its frequency = ..... and its periodic time = .....





## UNIT ONE

## Lesson

## 2

## Wave Motion

## Worksheet

## 3

## Question

## 1

## A Complete the following statements :

1. Wave motion is a kind of ..... motion.
2. The wave is a ..... which transfers ..... along its direction of propagation.
3. Waves are classified according to ..... into mechanical waves and electromagnetic waves.

## B Give reasons for :

1. Water waves are mechanical waves, while light waves are electromagnetic waves.

.....

.....

2. You see the light by a velocity larger than that of your hearing the sound.

.....

.....

## Question

## 2

## A Put (✓) or (✗), then correct what is wrong :

1. The movement of the clock pendulum is considered as a wave motion. ( )
2. Light and radio waves are examples of electromagnetic waves. ( )
3. Waves are classified according to the medium at which they propagate into transverse and longitudinal waves. ( )

## B Compare between : Mechanical and electromagnetic waves.

| Mechanical waves | Electromagnetic waves |
|------------------|-----------------------|
| .....            | .....                 |
| .....            | .....                 |
| .....            | .....                 |
| .....            | .....                 |



## PART

1

## Question

3

- A Show by an activity the role of wave in transferring energy.

.....

.....

.....

.....

- B From the opposite figure :



1. What is the type of this wave ?

.....

.....

2. What are the scientific terms that indicated by the numbers (1), (2) ?

(1) indicates : .....

(2) indicates : .....

## Worksheet 4

## Question

1

Complete the following :

- ..... waves are formed of crests and troughs.
- The crest in the transverse wave corresponds to ..... in the longitudinal wave, while the trough corresponds to .....
- The ..... is the lowest point of medium particles in the transverse wave.
- In the transverse waves, the particles of the medium vibrate ..... the wave propagation direction, while in the longitudinal waves, the particles of the medium vibrate ..... the direction of wave propagation.

## Question

2

- A What is meant by ...?

1. Wavelength of a transverse wave is 30 cm.

.....

2. Rarefaction.

.....

3. Crest.

.....



**B Give reasons for :**

1. The waves due to vibration of strings are mechanical transverse waves.

.....

.....

2. Jacuzzi is used in some hospitals and sport clubs.

.....

.....

**Question****3****A Study the opposite figure, then answer the following :**

1. Label points (A) and (B).

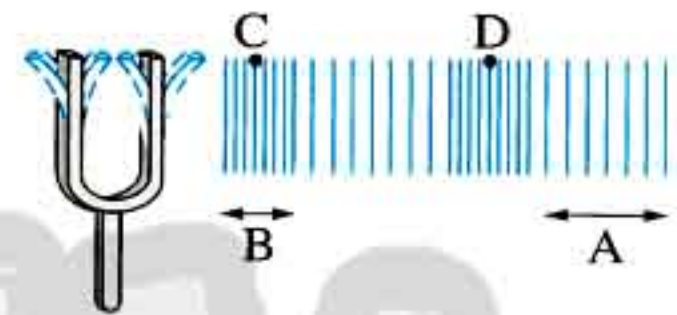
.....

2. What is the kind of the produced waves ?

.....

3. What's the name of the distance between (C) and (D) ?

.....

**B What are the results of ...?**

1. The vibration of the medium particles in a direction normal (perpendicular to) the direction of wave propagation.

.....

2. Propagation of a wave in a medium as pulses of crests and troughs (Concerning the particles of the medium).

.....

**Question****4****A Choose the correct answer :**

1. In the opposite figure, the particles of the medium (the coil) vibrate .....

a. to the right only.

b. upwards only.

c. upwards and downwards.

d. to right and left.

2. .... wave is an example of the longitudinal waves.

a. Water

b. Sound

c. Light

d. Radio

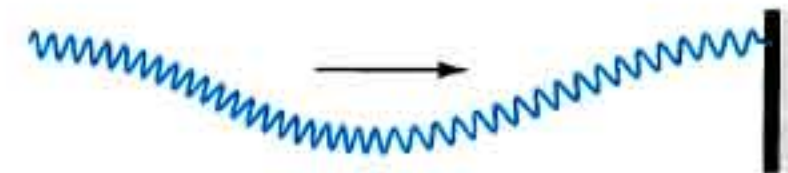
3. If the distance between the center of the third compression and the center of the fifth compression on the wave propagation is 20 cm, then the wavelength of this wave is .....

a. 40 cm.

b. 20 cm.

c. 10 cm.

d. 5 cm.





## PART

## 1

## B Write the scientific term :

1. The measuring unit of the wave frequency. (.....)
2. A design consists of a tub, where water moves in the form of circular waves for treating sprains and cramps. (.....)

## Worksheet 5

## Question

1

## A What does each of the following relationship indicate ?

1.  $\frac{\text{Distance covered by the wave}}{\text{Time}} = \dots\dots\dots$
2.  $\frac{1}{\text{Frequency}} = \dots\dots\dots$
3.  $\frac{\text{Wave velocity}}{\text{Wave frequency}} = \dots\dots\dots$

## B Write the scientific term :

1. The maximum displacement of medium particles away from their rest positions. (.....)
2. The relationship between the wave frequency and the wavelength in the wave motion. (.....)
3. The time of one wave. (.....)

## Question

2

## A What is meant by ...?

1. The distance that is covered by a radio wave in two seconds is  $6 \times 10^8$  metres.  
.....
2. Frequency of a transverse wave is 50 waves/second.  
.....

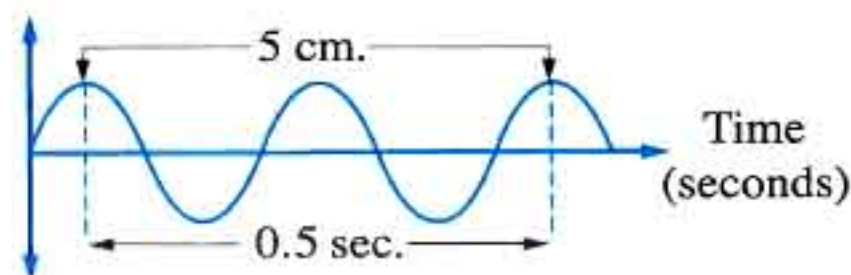
B Sound waves have frequency 400 Hz in air and its wavelength is 85 cm. Calculate the velocity of these waves.  
.....  
.....

## Question

3

## Complete the following :

1. From the opposite figure :
  - a) Wavelength = ..... cm.
  - b) Periodic time = ..... seconds.





## Worksheets

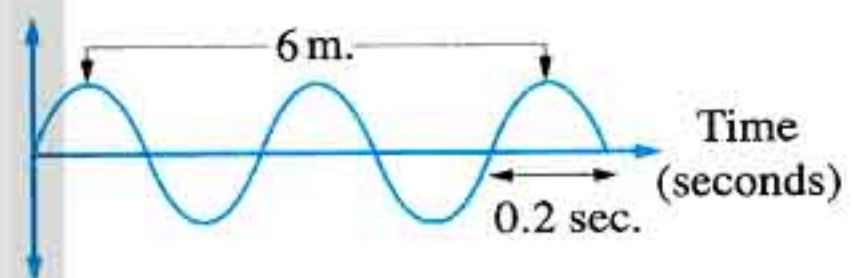
- Hertz is the measuring unit of .....
- ..... is the measuring unit of amplitude, while ..... is the measuring unit of wave velocity.
- The velocity of sound waves through air is ..... than its velocity through liquids, while its velocity through solids is ..... than that through liquids.
- Wavelength =  $\frac{\text{wave velocity}}{\text{.....}}$
- The frequency is ..... in one second.

## Question

4

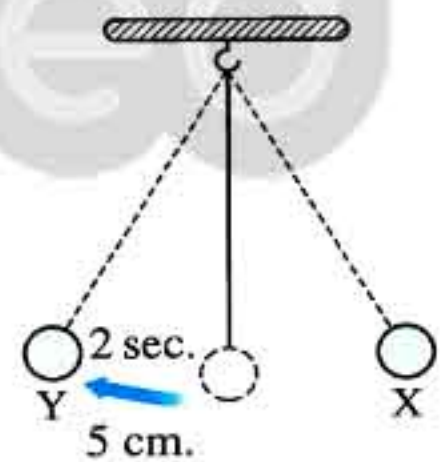
## A From the opposite figure. Find :

- Wavelength.
- The time of one wave (periodic time).
- Frequency.
- Wave velocity.



## B From the opposite figure choose the correct answer :

- The periodic time = .....
  - 2 sec.
  - 8 sec.
  - 6 sec.
  - 3 cm.
- The frequency = .....
  - 0.2 sec.
  - 0.4 Hz.
  - $\frac{1}{8}$  cycle/sec.
  - 0.4 m.
- Amplitude = .....
  - 0.2 sec.
  - 0.4 Hz.
  - 3 cm.
  - 5 cm.
- The distance covered in a complete oscillation = .....
  - 0.2 sec.
  - 0.4 Hz.
  - 20 cm.
  - 5 cm.



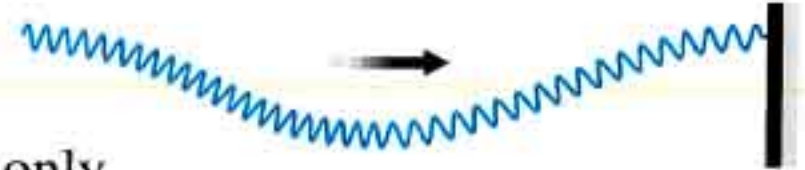


## General Exercise of the School Book

## on Unit ONE

## 1 Choose :

- If the distance between the center of the third compression and the center of the fifth compression on the wave propagation is 20 cm, then the wavelength of this wave is .....  
 a. 40 cm.                      b. 20 cm.                      c. 10 cm.                      d. 5 cm.
- In the opposite figure; the particles of the medium (the coil) vibrate .....  
 a. to the right only.                      b. upwards only.  
 c. to right and left.                      d. upwards and downwards.
- If the frequency of an oscillating body was 6 Hz, then the periodic time is ..... seconds.  
 a. 6                      b. 3                      c.  $\frac{1}{3}$                       d.  $\frac{1}{6}$



## 2 Cross the odd word out. Then, state the relation among the remaining words :

- Sound wave - Light wave - Radio wave - Infrared wave.  
 .....
- Pendulum motion - Spring motion - Rotary bee motion - Stretched string motion.  
 .....

## 3 Give reasons for each of the following :

- Oscillatory motion is considered as a periodic motion.  
 .....
- The waves due to vibration of strings are mechanical transverse waves.  
 .....
- We see lightning before hearing thunder.  
 .....

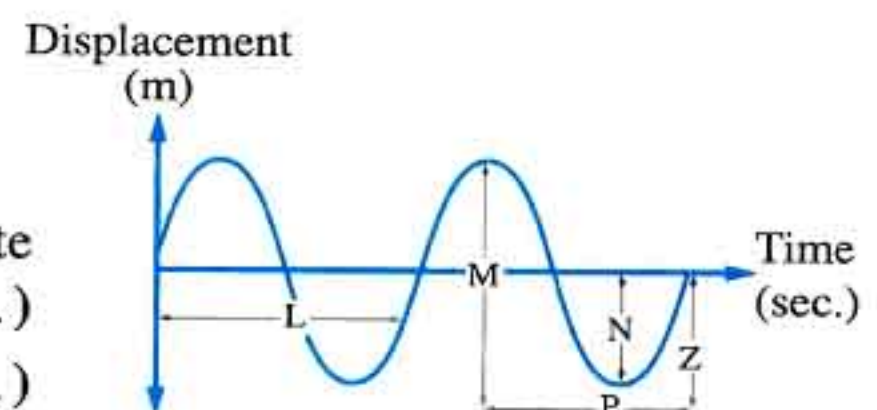
## 4 What are the results of ...?

- The vibration of the particles of a medium in a direction normal (perpendicular to) the direction of wave propagation.  
 .....
- The increase in the frequency of a wave to double its value with respect to the wavelength when the wave velocity is constant.  
 .....

## 5 The opposite figure represents an oscillatory motion for a simple pendulum.

Choose the letter that denotes :

- The oscillation of the pendulum forming  $\frac{3}{4}$  complete oscillation.  
 (.....)
- The amplitude.  
 (.....)





## Model Exams

## on Unit ONE

## Model Exam

1

20

Answer the following questions :

## Question 1 5 marks

Choose the correct answer :

- If the periodic time of a tuning fork is 4 sec, so the frequency is .....  
a. 4 Hz.                      b. 6 Hz.                      c.  $\frac{1}{4}$  Hz.                      d.  $\frac{1}{6}$  Hz.
- The sound waves are ..... waves.  
a. longitudinal                      b. transverse  
c. electromagnetic                      d. no correct answer
- The wave transfers ..... in the direction of propagation.  
a. molecules                      b. energy                      c. matter                      d. force
- The double of the horizontal distance between a crest and a trough of a transverse wave is known as .....  
a. frequency.                      b. wavelength.                      c. amplitude.                      d. wave velocity.
- The compression in the longitudinal wave is equivalent to .....  
a. the trough in the transverse wave.                      b. the crest in the transverse wave.  
c. the rarefaction in the longitudinal wave.                      d. the trough in the longitudinal wave.

## Question 2 5 marks

Put (✓) or (x) :

- The amplitude is the maximum displacement made by the oscillating body. ( )
- The simple pendulum is an example of the oscillatory motion. ( )
- The periodic time is the time taken by the oscillating body to make one complete oscillation. ( )
- The wavelength for a longitudinal wave is the distance between the first crest and the second crest. ( )
- The transverse wave is a disturbance that causes the movement of medium particles from their positions. ( )

## Question 3 5 marks

A Give reasons for :

- The motion of a swing is an example of the oscillatory motion.



## PART

## 1

2. The pendulum's velocity increases when the kinetic energy increases.  
.....
3. The wave velocity of light and radio waves is the same although their frequencies are different.  
.....

**B Write the scientific term :**

1. The measuring unit of wave velocity. (.....)
2. Physiotherapy tubs which are used to treat sprains, cramps and nervous tension. (.....)

**Question****4**

5 marks

Study the opposite figures, then answer the following questions :

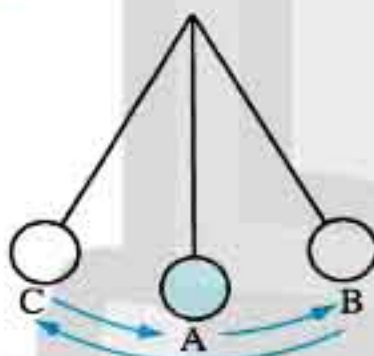


fig. (1)

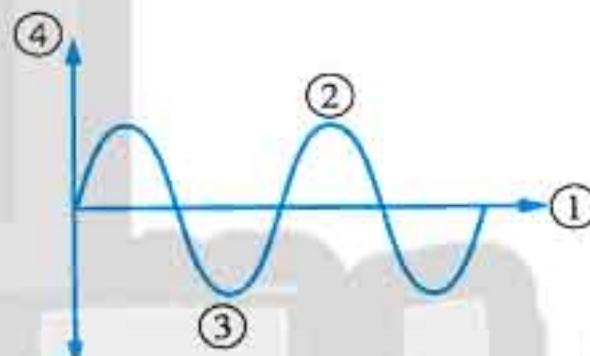


fig. (2)

1. What are these figures show ?  
.....
2. Label the figure (2).  
 (1) ..... (2) ..... (3) ..... (4) .....
3. What is the number of displacements in fig. (1) ?  
.....

**Model Exam****2**

20

Answer the following questions :

**Question****1**

5 marks

Complete the following :

1. If the wavelength of a sound wave is 2 metre, so the distance between the center of the first compression and the fifth one in this wave = .....
2. 20 megahertz = ..... gigahertz.
3. Kinetic energy =  $\frac{1}{2}$  .....  $\times$  .....
4. Tuning fork is considered one of the examples of ..... motion.
5. Jacuzzi is a tub where water moves in the form of ..... waves.



## Question 2 5 marks

Choose :

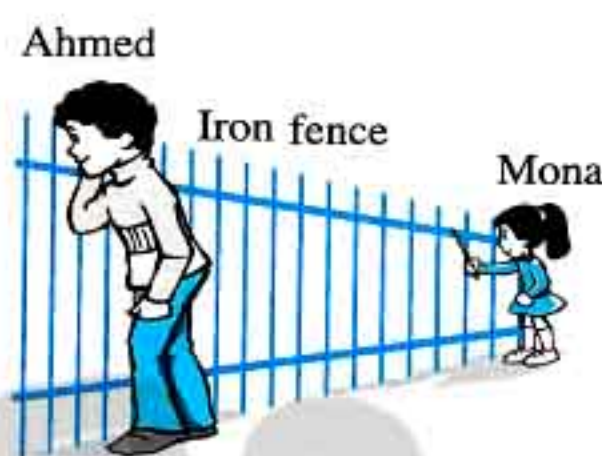
1. From the following table, the wave ..... is considered as an electromagnetic wave.

| Wave            | A                 | B               | C                 | D               |
|-----------------|-------------------|-----------------|-------------------|-----------------|
| Velocity m/sec. | 330               | 330             | $3 \times 10^8$   | $3 \times 10^8$ |
| Type            | Longitudinal wave | Transverse wave | Longitudinal wave | Transverse wave |

- a. A                      b. B                      c. C                      d. D

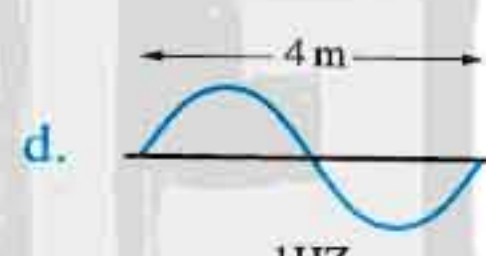
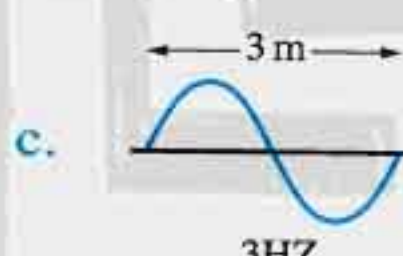
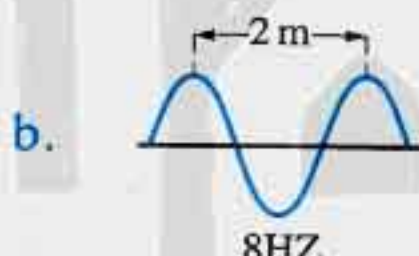
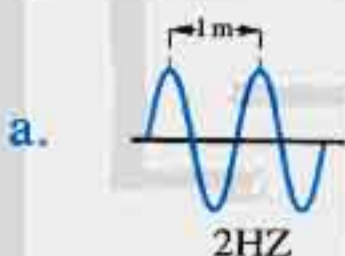
2. In the opposite figure :

Mona knocks on the iron fence. Then Ahmed hears the sound which transfers through air after 0.1 sec. and the sound which transfers through the iron fence after ..... sec.



- a. zero                      b. less than 0.1  
c. 0.1                      d. more than 0.1

3. The velocity of wave ..... is considered the largest one.



4. Sound velocity is the greatest through .....

- a. vacuum.                      b. solids.                      c. liquids.                      d. gases.

5. If the frequency of an oscillating body is 5 Hz. So, the product of multiplying of its frequency and its periodic time = .....

- a. 1                      b. 5                      c. 10                      d. 25

## Question 3 5 marks

- A What is meant by the velocity of a certain wave = 340 m/sec.

.....  
.....

- B Put (✓) or (✗) and correct what is wrong :

1. The rarefaction is the area in the longitudinal wave at which the particles of the medium are of the highest density and pressure.

( ) .....



## PART

## 1

2. Wave velocity is constant in the different media.

( ) .....

3. The motion of pendulum which includes 3 complete oscillation, includes 12 amplitudes.

( ) .....

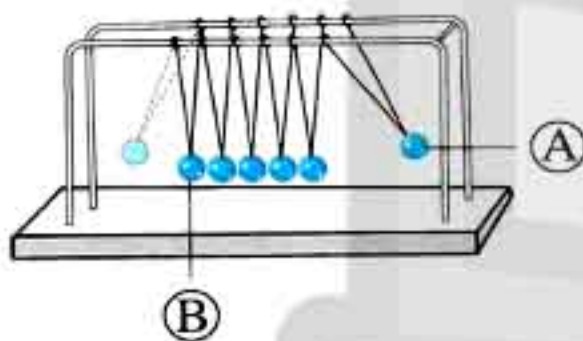
## Question

4

5 marks

**A** Study the two following figures, then answer to the questions followed by these figures :

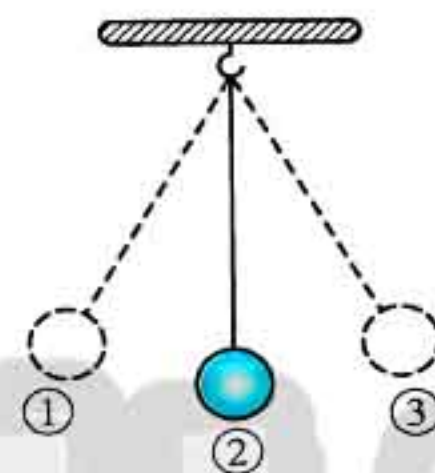
Fig. (1)



What is your explanation about the motion of ball (B) when ball (A) collides the other balls ?

.....  
 .....  
 .....

Fig. (2)



**Choose :**

The velocity of the pendulum ball is very small at the position .....

- a. (1)
- b. (2)
- c. (3)
- d. (1) and (3)

**B** If the distance between the center of the rarefaction and the center of the successive compression in the longitudinal wave = 0.02 m. **Calculate :**

1. The wavelength of the longitudinal wave.

.....

2. The wave velocity, if the frequency of this wave = 60 Hz.

.....

3. The periodic time, if the frequency of this wave = 40 Hz.

.....



## UNIT TWO

## Lesson

## 1

## Properties of Sound Waves

## Worksheet

## 6

## Question

## 1

Complete the following statements :

1. The human ear can differentiate between the sounds through different factors which are sound ....., sound ..... and sound .....
2. Sound is produced due to .....
3. Sound waves are ..... waves which travel through air as pulses of ..... and .....
4. The voice of lion is ..... pitch than that of sparrow.
5. The frequency of the vibrating string is ..... proportional to its length.
6. Musical tone is a sound of ..... frequency and it is produced from ..... and .....

## Question

## 2

1. If the frequency of sound produced from Savart's wheel is 1000 Hertz, when the metallic plate touches the teeth of a certain gear. Find the number of teeth of such gear if the wheel makes 250 rotations in one and a half minute.  
.....  
.....
2. A tuning fork produces a sound wave of frequency 512 Hz, if its wavelength is 65 cm. , calculate the velocity of sound through air in metre/sec.  
.....  
.....

## Question

## 3

What is meant by ...?

1. Sound pitch : .....
2. The wavelength of a sound wave equals 3 cm : .....
3. Sound velocity : .....

## Question

## 4

Mention an activity to show that the sound pitch depends on its frequency.

.....  
.....  
.....



## PART

## 1

## Question

5

## A Give reasons for :

1. We hear sound from all directions that surround the sound source.

.....

.....

2. The violin's player changes the length of strings during his play.

.....

B You have three gears in Savart's wheel shown in the table. Answer the following :  
By rotating them and touching each with a metallic plate.

1. The sharp sound is produced from touching the plate to the gear .....

| The gear no. | A  | B  | C  |
|--------------|----|----|----|
| No. of teeth | 20 | 40 | 60 |

2. Adham has run the wheel to 540 cycles/min. and the half of the frequency equals 180 Hz. Which gear has Adham touched with the plate ?

.....

## Worksheet

7

## Question

1

## Write the scientific term :

1. The measuring unit of sound intensity. (.....)
2. The intensity of sound at a point varies inversely with the square of the distance between that point and the sound source. (.....)
3. The characteristic by which the ear can distinguish between sounds as strong or weak. (.....)
4. The measuring unit of noise intensity. (.....)

## Question

2

## A Choose the correct answer :

1. All of the following are factors affecting sound intensity except the .....  
 a. amplitude of vibration.                      b. medium density.  
 c. frequency.                                      d. wind direction.
2. The intensity of sound in the presence of carbon dioxide as a medium for sound travels is ..... that in the presence of air.  
 a. equal to                      b. higher than                      c. lower than                      d. half of
3. The intensity of sound ..... when the direction of sound waves propagation is in the opposite direction of wind.  
 a. decreases                      b. increases                      c. doesn't change                      d. (a) or (b)



**B Give reasons for :**

1. The intensity of sound increases when the sound source touches a resonance box.  
.....
2. The intensity of sound decreases as the distance between the ear and sound source increases.  
.....  
.....

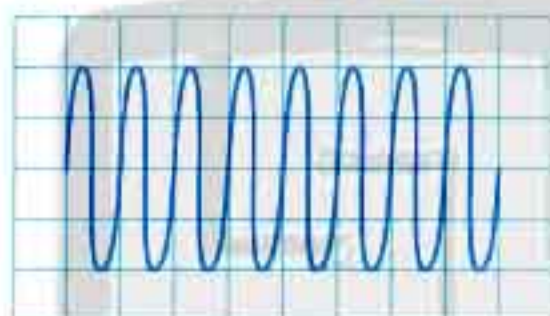
**Question 3**

**Mention the relationship between each of the following :**

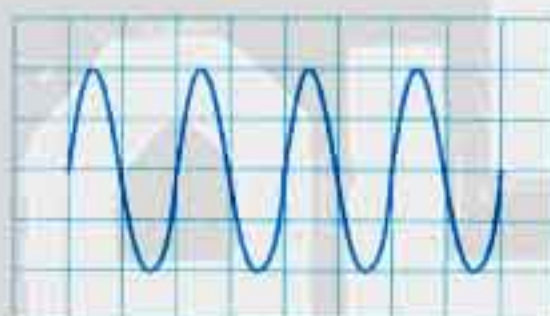
1. The sound intensity and the amplitude of vibration of the sound source.  
.....
2. The intensity of sound and the density of the medium through which the sound passes.  
.....

**Question 4**

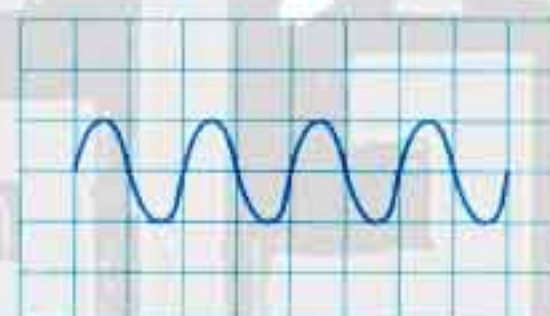
**Using the following figures, compare from the point of view of sound intensity and pitch between :**



Wave (A)



Wave (B)



Wave (C)

1. Sound wave (A) and sound wave (B) :  
.....
2. Sound wave (B) and sound wave (C) :  
.....

**Worksheet 8****Question 1****A Put (✓) or (✗) :**

1. Ultrasonic waves have frequencies less than 20 Hz. ( )
2. Sound of frequency 25000 Hz is audible sound. ( )
3. Bats, dogs and dolphins can hear ultrasonic waves. ( )

**B What is meant by ...?**

1. Sonic waves : .....
2. Sound quality : .....  
.....



## PART

## 1

## Question

## 2

You have several resonating sources with different frequencies :

These sources are arranged ascendingly according to their frequencies in the following table :

| Resonating source :               | 1  | 2  | 3     | 4     |
|-----------------------------------|----|----|-------|-------|
| Its frequency (vibrations/sec.) : | 10 | 50 | 10000 | 30000 |

- You can hear sound waves produced from vibration of source(s) .....  
[(1 , 2) , (2 , 4) , (1 , 4) , (2 , 3)] (Choose one answer)
- The waves used in food sterilization is produced from source(s) .....  
[(1 , 2) , (2 , 3) , (4 only) , (3 , 4)] (Choose one answer)
- Does any of these waves travel through free space ? Why ? (Answer)  
.....
- The waves that are produced from the vibration of the vibrating sources are called :  
a. Sonic in case of ..... b. Ultrasonic in case of .....  
c. Infrasonic in case of ..... (Complete)

## Question

## 3

Give reasons for :

- The human ears can hear sounds of frequencies ranging from 20 Hz to 20000 Hz.  
.....  
.....
- Piano's sound differs from violin's sound even if they have the same intensity and pitch.  
.....  
.....
- The importance of ultrasonic waves.  
.....

## Question

## 4

A person stands near an apparatus producing different sounds of different frequencies as follows :

12 Hz , 15 Hz , 35 Hz , 50 Hz , 1000 Hz , 15 000 Hz , 20 000 Hz , 25 000 Hz.

Which of these sounds will be heard by such person ? Why?

.....  
.....



## UNIT TWO

## Lesson

## 2

## Wave Nature of Light

## Worksheet

## 9

## Question

## 1

What is meant by ...?

1. Speed of light : .....
2. Light : .....
3. Visible light : .....

## Question

## 2

A Give reasons for :

1. The energy of red light photon is less than that of orange light photon.

2. Light can travel through free space.

B Mention the uses of light ?

## Question

## 3

Choose the correct answer :

1. Light waves are ..... waves.
  - a. mechanical transverse
  - b. electromagnetic transverse
  - c. electromagnetic longitudinal
  - d. mechanical longitudinal
2. The quantum of energy of green light is ..... the quantum of energy of yellow light.
  - a. greater than
  - b. equal to
  - c. less than
  - d. no correct answer
3. All of the following are from the characteristics of the red colour in spectrum colours except .....
  - a. it has the lowest frequency.
  - b. its photon energy is the smallest one.
  - c. its photon has the highest deviation.
  - d. it has the longest wavelength.



## PART

## 1

4. Energy of the photon equals .....
- Planck's constant + Frequency.
  - Planck's constant  $\div$  Frequency.
  - Planck's constant  $\times$  Frequency.
  - Planck's constant - Frequency.
5. .... scientist proved that the energy of light waves is composed of photons.
- Isaac Newton
  - Kepler
  - Al-Hassan Ibn El-Haitham
  - Max Planck

## Worksheet 10

## Question

1

Compare between : transparent medium and translucent medium :

| Points of comparison | Transparent medium | Translucent medium |
|----------------------|--------------------|--------------------|
| • Definition :       | .....              | .....              |
| • Examples :         | .....              | .....              |

## Question

2

Write the scientific term :

- A medium doesn't allow light rays to penetrate through. (.....)
- The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light. (.....)
- The quantity of light falling perpendicular to a unit area of a surface in one second. (.....)

## Question

3

Put (✓) or (✗) :

- The light travels in curved lines through transparent medium. ( )
- By increasing the thickness of the transparent medium, the quantity of light that passes through it increases. ( )
- Carton and human skin are examples of opaque medium. ( )



## Question

4

Explain an activity to demonstrate that light travels in straight lines through transparent media :

.....

.....

.....

.....

.....

## Question

5

Give reasons for :

1. The inability to see the impurities present in black honey.

.....

.....

2. The intensity of light on a surface decreases to its quarter when the distance between the light source and this surface is doubled.

.....

.....

3. The clothes pins can be seen clearly before and after placing them in a transparent plastic bag.

.....

.....

4. Carton is an opaque medium.

.....

.....



## Question

1

Complete the following :

1. The energy of the photon is ..... proportional to the ..... of light wave.
2. .... waves are audible sounds.
3. White light consists of a mixture of seven colours which are known as .....
4. High pitch sounds have relatively large ..... and small .....
5. By increasing the speed of rotation in Savart's wheel the frequency ..... , the sound becomes .....

## Question

2

- A** Calculate the number of the gear teeth of Savart's wheel, given that the frequency of the sound produced is 100 Hz. and the wheel rotates 30 cycles/min.

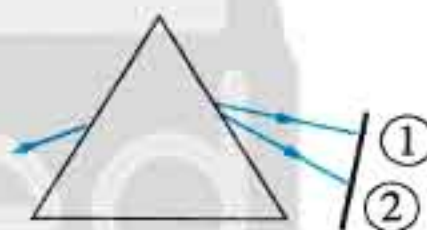
.....

.....

.....

- B** In the opposite figure :

Which ray represents the red colour and which ray represents the violet colour ?



.....

.....

## Question

3

- A** Choose the unsuitable word, then express the rest of the words with something proper.

1. Yellow / Blue / White / Violet

.....

2. Violin / Drill / Piano / Reed pipe

.....

- B** Put (✓) or (✗), then correct what is wrong :

1. The sound velocity through liquids is less than that through gases.

( ) .....



2. Light travels through transparent media in the form of straight lines

( ) .....

3. Sound wave of frequency 15000 Hz is audible sound.

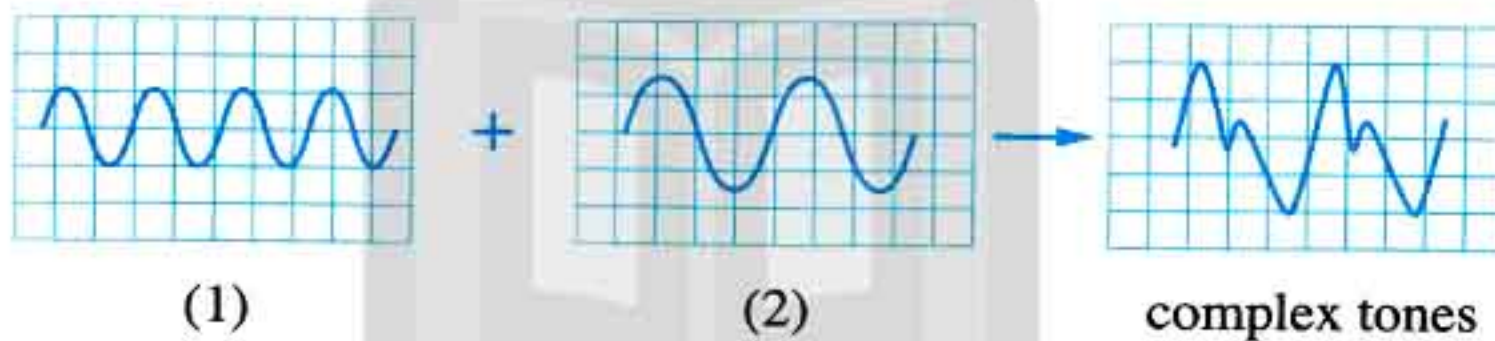
( ) .....

#### Question

4

The following figures shows the formation of complex tones.

Which of the two figures (1), (2) represents the fundamental tone and which one represents the harmonic tone. (give a reason).



.....

.....

.....

.....



## UNIT TWO

## Lesson

## 3

## Reflection and Refraction of Light

## Worksheet 12

## Question

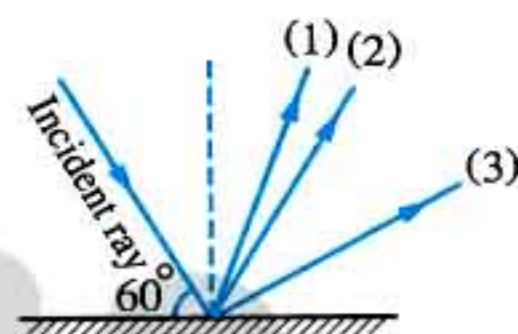
1

## A Write the scientific term :

1. A smooth or rough surface at which the reflection of light takes place. (.....)
2. The angle between the incident ray and the line perpendicular to the reflecting surface at the point of incidence. (.....)

## B From the opposite figure, answer the following :

1. The reflected ray is number .....
2. The angle of reflection = .....



## Question

2

## A What is meant by ...?

1. Light reflection : .....
2. Angle of reflection : .....

## B Study the following figures, then answer the questions :

1. Find the value of the angle of incidence and the angle of reflection in each of the following cases :

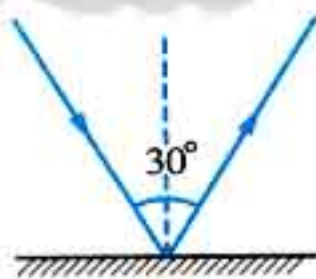


Fig. (1)

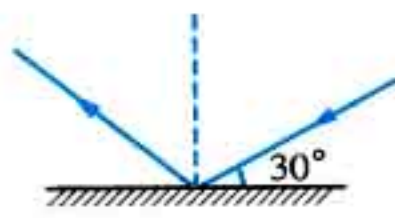


Fig. (2)

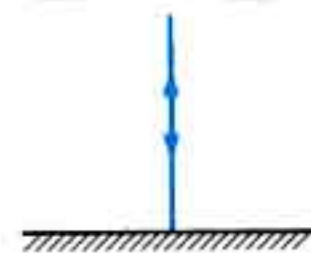
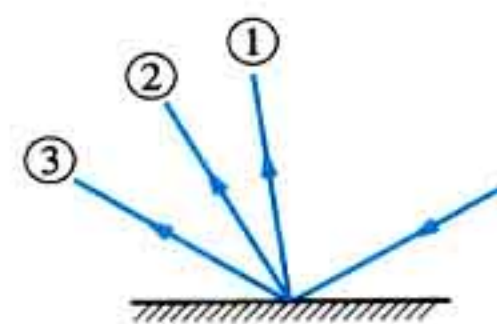


Fig. (3)

2. Which of the following reflected rays represents the reflected ray in the right direction and why ?





## Question

3

A State the two laws of light reflection :

- \* First law : .....
- \* Second law : .....
- .....
- .....

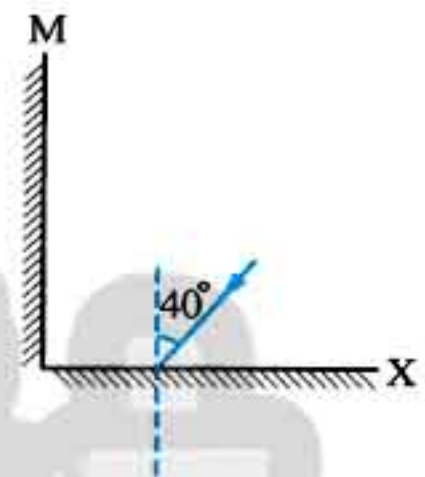
B Choose the correct answer :

1. If the angle between the incident ray and the reflecting surface is  $60^\circ$ , then the angle between the incident and the reflected rays will be .....

- a.  $30^\circ$       b.  $60^\circ$       c.  $15^\circ$       d.  $120^\circ$

2. In the opposite figure, when a ray of light falls on the mirror (X) by an angle  $40^\circ$ , the reflected ray will fall on the surface of the mirror (M) by angle of incidence equals .....

- a.  $30^\circ$       b.  $60^\circ$       c.  $40^\circ$       d.  $50^\circ$



## Question

4

What happens when ... ?

1. A light ray falls perpendicular on a reflecting surface. Why ?

.....

.....

2. Incidence of light rays on a rough surface.

.....

.....

## Worksheet 13

## Question

1

A Give reasons for :

1. The light refracts when it travels from a transparent medium to another of different optical density.

.....

.....



## PART

## 1

2. The absolute refractive index of any transparent medium is larger than one.

.....

.....

3. A coin in a glass of water appears in a position higher than its true position.

.....

.....

**B Complete the following :**

- When a light ray travels from a transparent medium of higher optical density to another of lower optical density, the angle of ..... is more than the angle of .....
- Light ..... is the change of light path when it travels from a transparent medium to another one of different .....

**Question**

**2**

**A Show by drawing the path of the ray by which the eye can see the body.**

**B Choose the correct answer :**

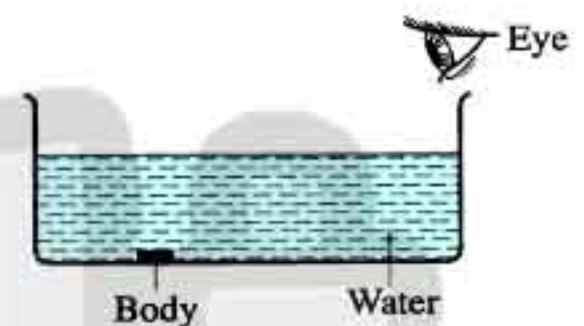
A hunter standing on the shore of the sea, he wants to catch fish under water surface, so he should direct the arrow .....

a. to the body of the fish.

c. below the body of the fish.

b. above the body of the fish.

d. beside the body of the fish.



**Question**

**3**

**What happens when ...?**

1. A light ray falls perpendicular to the interface between two transparent media of different optical densities.

.....

.....

2. You look at a pencil partially immersed in a cup of water. Why ?

.....

.....



## Question

4

## A Write the scientific term :

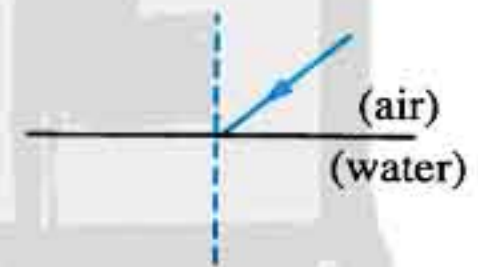
1. A natural phenomenon that takes place on desert roads at noon in summer times. (.....)
2. The ability of the transparent medium to refract the light. (.....)
3. The angle between the emergent light ray and the normal at the point of emergence on the interface. (.....)

## B What is meant by ...?

1. The refractive index of water is 1.3  
.....  
.....
2. The angle of refraction.  
.....  
.....

## C Complete the opposite figure, then answer the following :

1. The light ray refracts ..... the normal.
2. The angle of ..... is greater than the angle of .....





## General Exercise of the School Book

## on Unit TWO

## 1 Write the scientific term :

1. Sound waves of frequencies less than 20 Hz. (.....)
2. A medium does not allow light rays to penetrate through. (.....)
3. Changing the path of light when travel from a transparent medium to another transparent medium of different optical density. (.....)
4. The incident light ray, reflected light ray and the normal at the point of incidence on the reflecting surface all lie in one plane perpendicular to the reflecting surface. (.....)

## 2 Choose the correct answer, with the scientific explanation :

1. Sound of frequency 200 Hz is ..... than sound of frequency 100 Hz.  
a. sharper      b. stronger      c. harsher      d. weaker
2. When the distance between the source of light and the surface as a wall decreases, the light intensity on the surface .....  
a. decrease.      b. increases.      c. doubled.      d. remains constant.

## 3 Write down the mathematical relation that joins between each of the following :

1. The photon frequency and its energy.  
.....
2. The sound frequency (f), the number of teeth of the gear in Savart's wheel (n).  
.....

## 4 What are the results due to each of the following ?

1. Incidence of light rays on a rough surface.  
.....  
.....
2. Incidence of a white light ray on one face of a triangular glass prism.  
.....  
.....



## Worksheets

## 5 What is the scientific basis on which the following depends ?

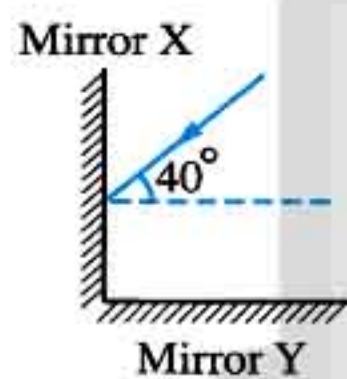
The strings of a musical lute are fixed on a hallow wooden box.

.....

.....

## 6 Complete the path of rays in each of the following figures according to what is written below each :

A

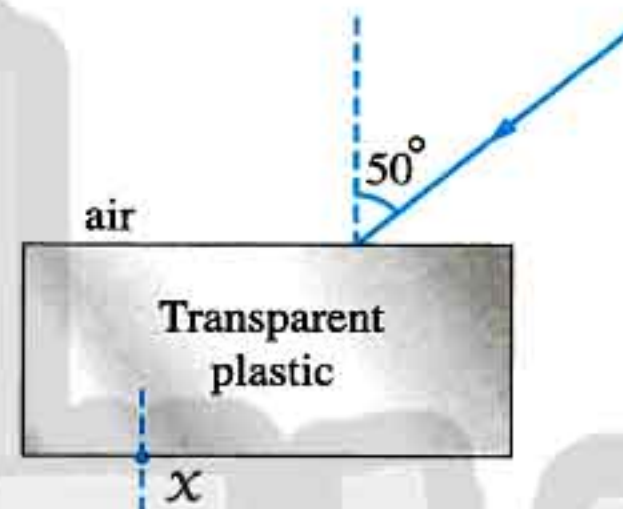


Determination of the angle of reflection of the ray on mirror (Y)

.....

.....

B



Calculating the angle of emergence from point (X) given that the optical density of air is less

.....

.....



## Model Exams

## on Unit TWO

## Model Exam

1

20

Answer the following questions :

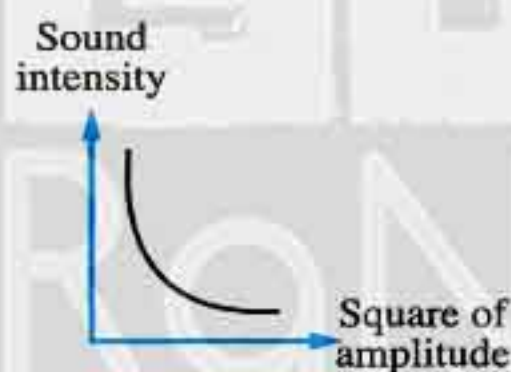
## Question

1

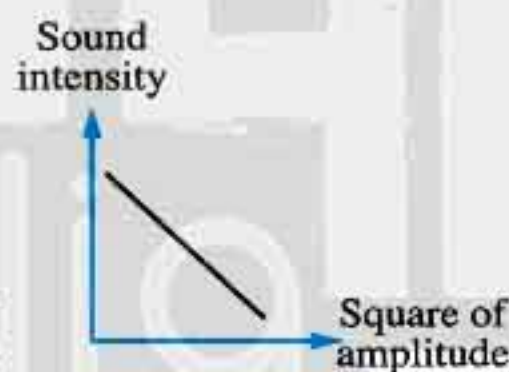
5 marks

## A Choose the correct answer :

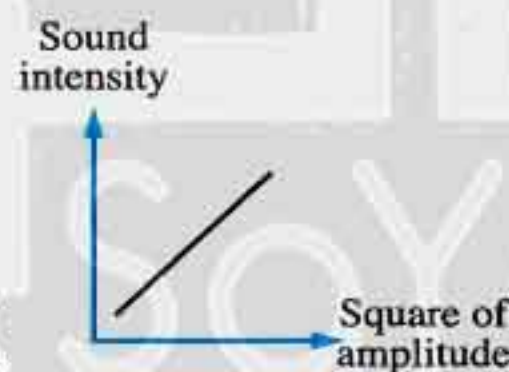
- The substance that a sound wave travel through is called the .....  
a. medium.      b. vacuum.      c. rarefaction.      d. mediary.
- The angle of incidence of light is ..... its angle of reflection.  
a. larger than      b. smaller than      c. equal to      d. no correct answer
- The human skin is considered as a/an ..... medium.  
a. transparent      b. semi transparent      c. opaque      d. no correct answer
- The figure ..... represents the relation between the intensity of sound and the square of amplitude of vibration of a vibrating body.



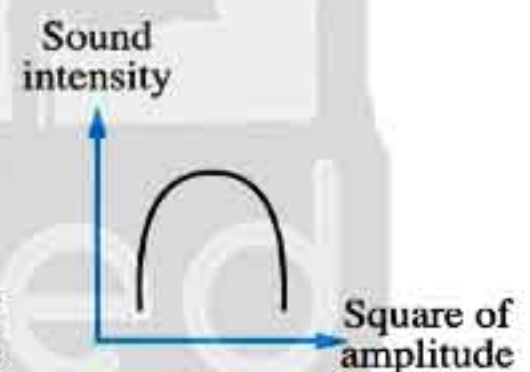
a.



b.



c.



d.

- When a light ray travels from air to water, it .....  
a. refracts near the normal.      b. refracts far from the normal.  
c. passes with out refraction.      d. reflects.

## B Give reasons for :

- The pencil which is partially immersed in water, appears as being broken.

.....

.....

- The difference in frequency between the musical tone and noise.

.....

.....

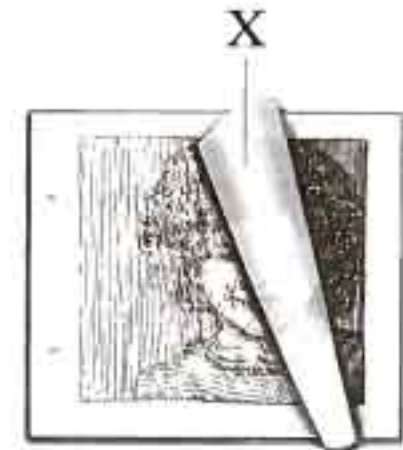


**Question 2** 5 marks**A Write down the scientific term :**

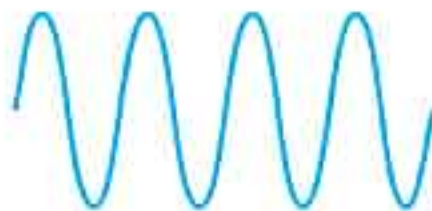
1. A tone of regular frequency that is produced from reed pipe. (.....)
2. The ability of the medium to refract light rays. (.....)
3. Seven colours are produced as a result of splitting of the white light. (.....)

**B From the opposite figure :**

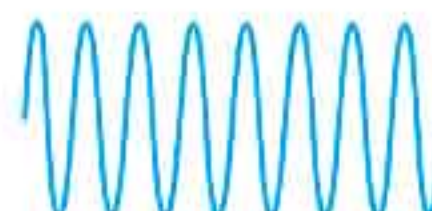
1. What is the type of slide that placed over the image ?  
.....
2. Explain why, we can't see the part present below (X) clearly ?  
.....

**Question 3** 5 marks**What is meant by ...?**

1. The angle of reflection of light ray =  $30^\circ$   
.....
2. Visible light.  
.....
3. Sound quality.  
.....
4. The velocity of light is  $3 \times 10^8$  m/sec.  
.....
5. Inverse square law in sound.  
.....

**Question 4** 5 marks**A Compare between the two waves (A) , (B) in terms of pitch : Give a reason.**

Wave (B)



Wave (A)

The sound pitch of wave ..... is higher than the sound pitch of wave .....

That because : .....



PART

1

- B Explain with drawing an activity to conclude the two laws of light reflection.

.....

.....

.....

.....

## Model Exam

2

20

Answer the following questions :

Question

1

5 marks

- A Complete the following statements:

1. The light reflection is classified into two types which are ..... and .....
2. Sounds of different musical instruments can differentiated from each other by .....
3. When you look at a coin in a glass of water, its ..... position appears to be lower than the ..... position
4. The light intensity is the amount of light .....
5. Some animals such as ..... , ..... and ..... can hear ultrasonic waves.

- B Mention the factors affecting the sound intensity.

.....

.....

.....

.....

Question

2

5 marks

- A Define :

1. The reflected ray.

.....

.....

2. Transparent medium.

.....

.....

3. Sound velocity.

.....

.....



## Worksheets

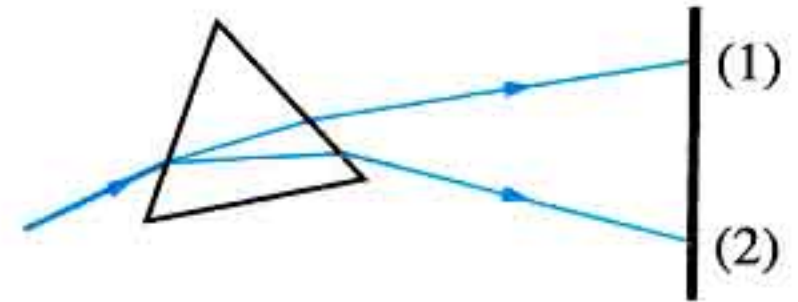
**B** In the opposite figure :

1. Which ray represents the red colour and which ray represents the violet colour ?

.....

2. Which one has a greater energy, the photon of red light or the photon of violet light ?

.....

**Question****3**

5 marks

- A** Compare between regular reflection and irregular reflection.

.....  
 .....  
 .....  
 .....

**B** What happens when ...?

1. The number of rotations per second of Savart's wheel increases.  
 .....  
 2. A light ray travels from air to glass.  
 .....  
 3. The distance between the sound source and the ears increases twice.  
 .....

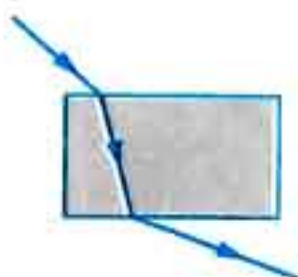
**Question****4**

5 marks

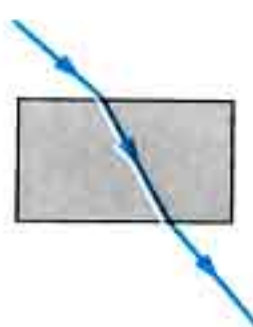
- A** Calculate the absolute refractive index of water, knowing that the velocity of light through water is  $2.25 \times 10^8$  m/s. and the velocity of light through air is  $3 \times 10^8$  m/s.

.....  
 .....

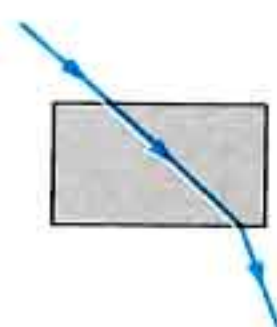
- B** Choose from the following figures the one that expresses correctly the refraction of light in a rectangular glass block and mention the reason. ....



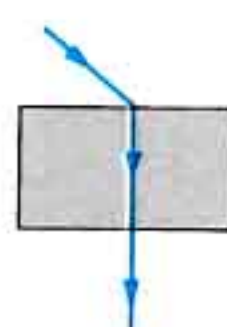
(A)



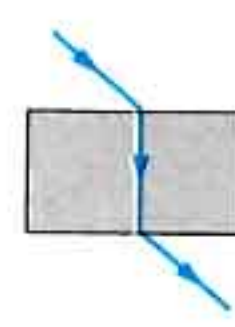
(B)



(C)



(D)



(E)



## UNIT THREE

## Lesson

## 1

## Reproduction in Plants

## Worksheet 14

## Question

## 1

Study the opposite figure, then answer the following :

1. The figure represents a ..... flower.

2. Label the figure.

① .....

③ .....

⑤ .....

⑦ .....

⑨ .....

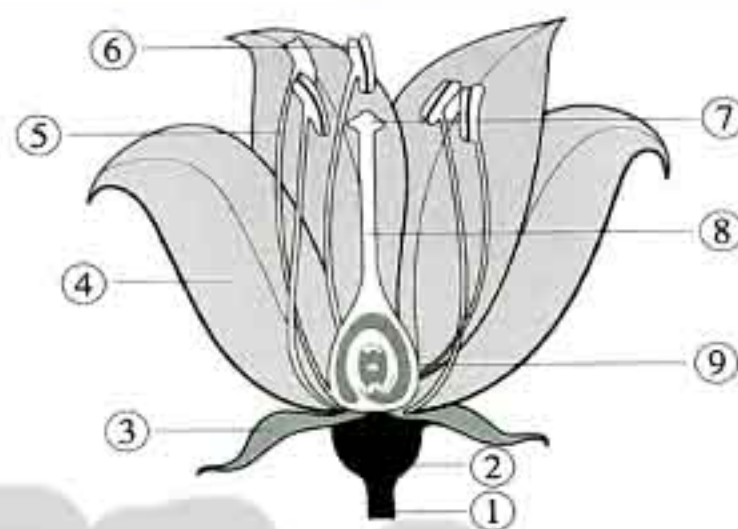
② .....

④ .....

⑥ .....

⑧ .....

3. The organ which consists of parts (7) , (8) and (9) is called ..... , while the organ which consists of parts (5) and (6) is called .....



## Question

## 2

## A Give reasons for :

1. Palm trees are not bisexual.

.....

2. Petals of corolla are colourful and scented.

.....

## B Mention the function of :

1. Sepals of calyx : .....

2. Carpel : .....

## Question

## 3

## A Write the scientific term :

1. The female reproductive organ of the flower.

(.....)

2. The innermost whorl of a male flower.

(.....)

3. Minute cells formed inside the flower's anther.

(.....)



### B What is meant by hermaphrodite flower ?

#### Question 4

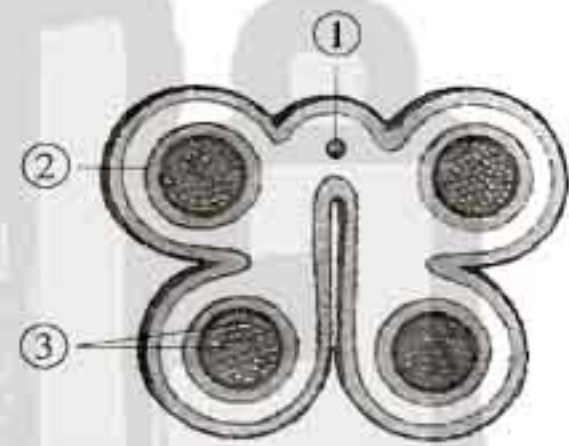
#### A Choose the correct answer :

- The male flower consists of ..... whorls.  
a. 2                      b. 3                      c. 4                      d. 5
- The symbol of female flower is .....  
a. ♀                      b. ♂                      c. ♀                      d. ⊕
- The ovary of a flower contains .....  
a. pollen grains.      b. anthers.              c. stigmas.              d. ovules.

#### B From the opposite figure, answer the following questions :

- The figure represents a cross section in an .....
- Label the figure.

- ① .....
- ② .....
- ③ .....



### Worksheet 15

#### Question 1

#### A Complete the following :

- ..... in plants takes place in two successive processes which are pollination then .....
- ..... fruit has a single seed, while ..... fruit has many seeds.
- Artificial pollination is carried out by ..... such as in .....

#### B Choose the correct answer :

- Flowers which produce light and dry pollen grains are pollinated by .....  
a. man.                      b. wind.                      c. water.                      d. insects.
- After fertilization, the ovary develops and becomes the .....  
a. fruit.                      b. seed.                      c. flower.                      d. embryo.



## PART

## 1

## Question

## 2

## A What is meant by ...?

1. Fertilization : .....
2. Micropyle : .....

## B What happens when ...?

1. A pollen grain falls on a flower's stigma.  
.....
2. Sepals of insect pollinated flowers are not coloured and have no scent.  
.....
3. Pollen grains become mature (related to the anther).  
.....

## Question

## 3

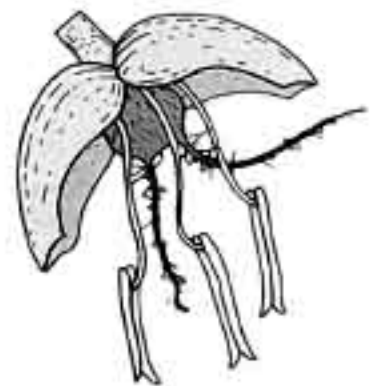
## A Give reasons for :

1. Pollen grains of wind pollinated flowers are produced in a huge number.  
.....
2. Pollen grains of insects pollinated flowers are sticky or with coarse surfaces.  
.....

## B From the opposite figure :

Mention the way by which the pollination process takes place.

Giving a reason.



.....

.....

.....



## Question 4

## A Compare between :

Auto pollination and mixed pollination.

| Auto pollination | Mixed pollination |
|------------------|-------------------|
| .....            | .....             |
| .....            | .....             |
| .....            | .....             |

## B Examine the opposite figure, then answer the following :

Write the names of the parts numbered from ① to ⑦.

① .....

② .....

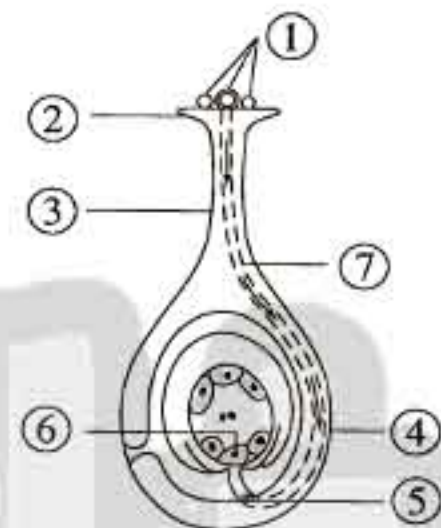
③ .....

④ .....

⑤ .....

⑥ .....

⑦ .....



## Worksheet 16

## Question 1

## A Complete the following :

- ..... reproduction is a kind of asexual reproduction which may be ..... or .....
- ..... may be a root as sweet potatoes or a stem as .....
- Tissue culture is .....

## B Choose the correct answer :

- ..... is a way from the ways of the natural vegetative reproduction.
  - Cutting
  - Tubers
  - Grafting
  - Tissue culture
- Reproduction by grafting can be used between all of the following plants except .....
  - orange and naring.
  - apples and pears.
  - mango and apples.
  - peaches and apricots.



## PART

1

## Question

2

From the opposite figure, which represents a kind of reproduction :

1. Label the figure.

① .....

② .....

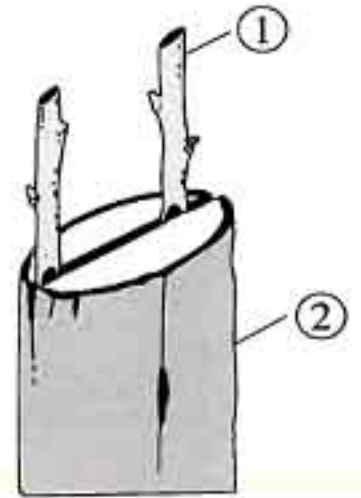
2. Mention its kind.

.....

3. Complete :

a. The part no. ① must be containing more than .....

b. The part no. ① is ..... into a ..... in the part no. ②.



## Question

3

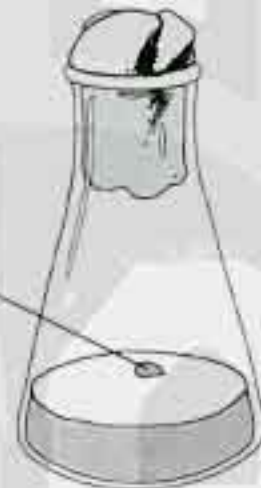
The following figure represents steps of tissue culture of potato stem.

Complete the missing parts under each figure.



The tissue is separated from the ..... part of the .....

(a)



The tissue is placed in a ..... medium containing ..... and .....

(b)



The new plant starts to grow till certain size.

(c)



The plant is then ..... to the ..... to grow normally.

(d)

## Question

4

A Mention an activity to show reproduction by cutting of sugar cane :

Steps :

.....  
 .....  
 .....

Observations :

.....  
 .....

B Mention four ways of natural vegetative reproduction :

- .....
- .....

- .....
- .....



## UNIT THREE

## Lesson

## 2

## Reproduction in Man

## Worksheet

## 17

## Question

## 1

**A** Study the opposite figure, then answer the following questions :

1. What is its name ?

.....

2. Mention what the numbers indicate.

① .....

③ .....

⑤ .....

⑦ .....

⑨ .....

⑪ .....

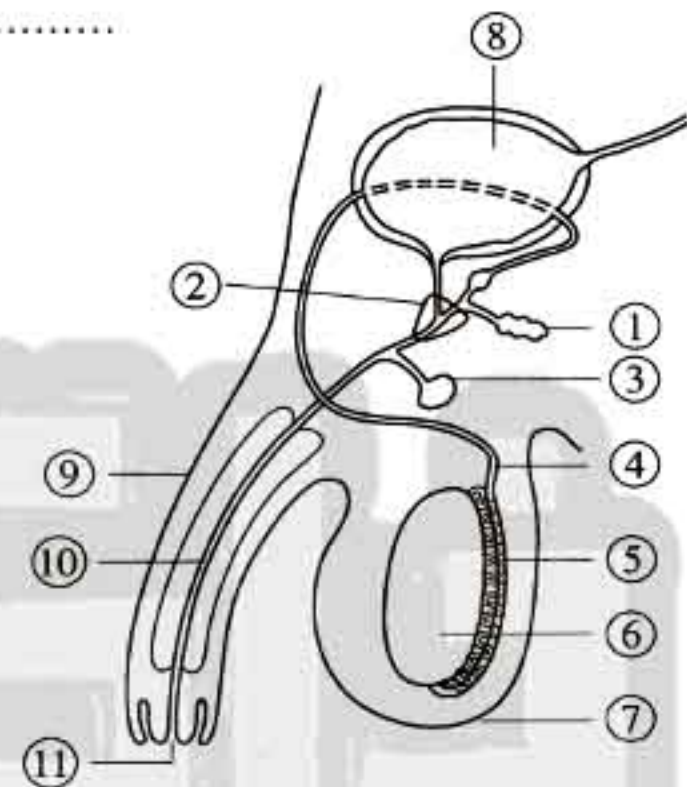
② .....

④ .....

⑥ .....

⑧ .....

⑩ .....



3. Mention the function of part ①.

.....

**B** Mention the aim of reproduction process in humans.

.....

## Question

## 2

**A** Complete the following :

1. Each testis is connected to a group of fine convoluted tubes called ..... which extends in the form of single tube known as .....

2. Testes produce ..... hormone which is responsible for the appearance of ..... in male.

**B** Mention the signs of puberty in male.

.....

.....

.....



## PART

## 1

## Question

3

## A Mention the function of :

1. Scrotum :

.....

2. The fluid which is secreted by the genital glands :

.....

## B Give a reason for :

The type of reproduction in human is sexual and not asexual.

.....

.....

## Question

4

## A What happens when ... ?

1. The testes are not found inside the scrotal sac but they are found inside the abdominal cavity of man body.

.....

.....

2. The seminal fluid is neutral fluid.

.....

## B Write the scientific term :

1. An oval-shaped gland that produces male cells.

(.....)

2. A part of male reproductive system that transfers the sperms from testes to urinogenital duct.

(.....)

3. A hormone produced by the testis.

(.....)

## Worksheet 18

## Question

1

Study the following figure which represents the human female reproductive system , then answer the following questions :

## A What does each number of the figure refer to ?

① .....

② .....

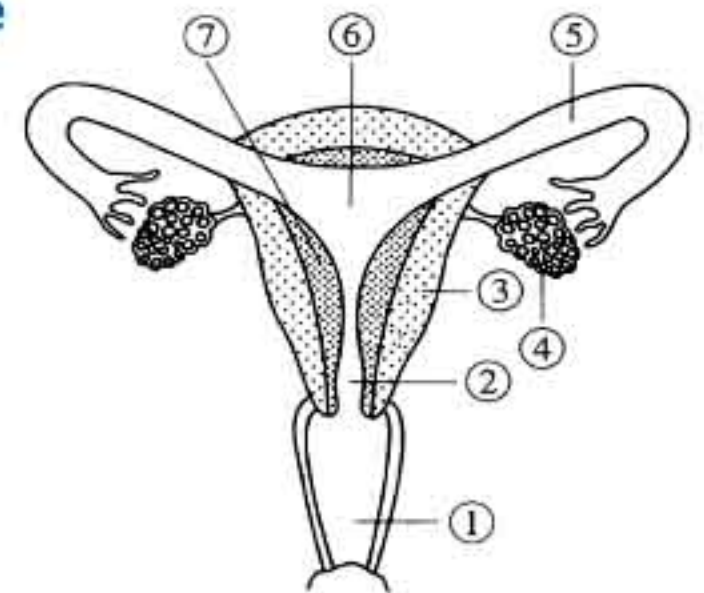
③ .....

④ .....

⑤ .....

⑥ .....

⑦ .....





## Worksheets

## B What is the organ which ?

1. Produces female sex hormone. (.....)
2. Receives the ripe ovum and directs it towards the uterus. (.....)
3. Locates between the urinary bladder and the rectum. (.....)

## Question 2

## A Mention the function of :

1. The placenta : .....
2. The midpiece of a sperm : .....

## B Write the scientific term :

1. The female sex hormone which is responsible for the occurrence and continuity of pregnancy. (.....)
2. Structures carry genes which are responsible for the hereditary traits of the species. (.....)

## Question 3

## A Mention the signs of puberty in female. (3 only)

1. ....
2. ....
3. ....

## B Choose the correct answer :

1. The nucleus of the male or female reproductive cells in human contains ..... chromosomes.  
a. 23                      b. 32                      c. 46                      d. 64
2. The ovum ..... like the sperm.  
a. is static                      b. is mobile                      c. has large size                      d. contains 23 chromosomes
3. The ..... is a gland has the size of a peeled almond.  
a. uterus                      b. ovary                      c. ovum                      d. vagina

## Question 4

## A Correct the following statements without changing the underlined words :

1. The estrogen enzyme is responsible for the appearance of secondary sex characters in female.  
.....



## PART

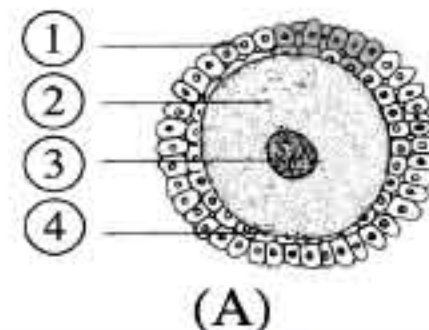
## 1

2. The ovum of the human male contains half the genetic material.

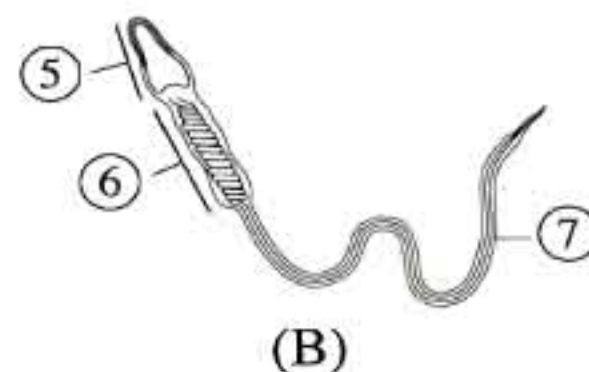
**B From the two opposite figures :**

**A) Complete :**

1. Fig. (A) represents .....
2. Fig. (B) represents .....
3. No. ① represents .....
4. No. ② represents .....
5. No. ③ represents .....
6. No. ④ represents .....
7. No. ⑤ represents .....
8. No. ⑥ represents .....
9. No. ⑦ represents .....



(A)



(B)

**B) What is the organ which produces (A) and (B) ?**

(A) Produced from .....

(B) Produced from .....

**C) What is the secretion which is secreted by part ⑤ ?**

And what is the importance of it ?

**Worksheet 19**

**Question**

**1**

**A) What is meant by the incubation period ?**

**B) Complete the following :**

1. The human female produces ..... in the 14<sup>th</sup> day of the beginning of the menstrual cycle.
2. The head of the sperm secretes ..... which dissolve the ..... of the ovum to facilitate its penetration inside the ovum.
3. The place at which the sperm attacks the ovum is .....
4. .... disease is transmitted from the pregnant woman to her fetus through the umbilical cord or during the delivery.



## Worksheets

## C Explain :

The new born body will carry the genetic traits of his parents.

.....

.....

## Question 2

## A Choose the correct answer :

- In human, the ..... contains 23 pairs of chromosomes.  
a. sperm      b. ovum      c. zygote      d. sperm and ovum
- All the following are sexually transmitted diseases except .....  
a. Gonorrhea.      b. AIDS.      c. Prostate cancer.      d. Syphilis.
- The incubation period of ..... disease ranges from 1 to 4 days.  
a. puerperal sepsis      b. prostate cancer      c. syphilis      d. gonorrhea
- Which of the following genital diseases can be transmitted by means of droplets ? .....  
a. Syphilis.      b. AIDS.      c. Gonorrhea.      d. Puerperal sepsis.

## B What are the complications of syphilis disease ?

.....

.....

.....

## Question 3

Fig. (1) and (2) are two types of bacteria which cause two different venereal diseases.

- Detect the shape of bacteria in each figure and the name of the disease caused by it.



Fig. (1)

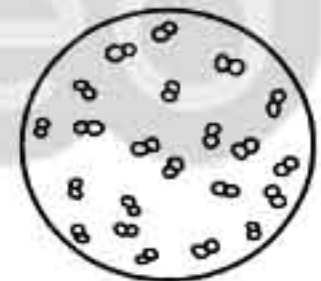


Fig. (2)

- Mention the symptoms of each disease.

| Symptoms of the disease caused by fig. (1) | Symptoms of the disease caused by fig. (2) |
|--|--|
| .....                                      | .....                                      |
| .....                                      | .....                                      |
| .....                                      | .....                                      |
| .....                                      | .....                                      |
| .....                                      | .....                                      |



PART

1

Question

4

A Mention the means of protection of puerperal sepsis disease.

.....

.....

.....

.....

B Mention the methods of infection of puerperal sepsis disease.

.....

.....

.....

.....

ذاكر اولي

Ra Nia SaYed



## General Exercise of the School Book



## on Unit THREE

## 1 Write the scientific term for each of the following :

1. An oval shaped gland that produces male cells. (.....)
2. Flowers contain male and female organs together. (.....)
3. The process of producing ova from the ovaries mutually every 28 days. (.....)
4. The reproduction of some plants by parts of the roots, stem or leaves. (.....)

## 2 Correct the following sentences without changing the underlined words :

1. The wall of the ovary after pollination forms the wall of the fruit.  
.....
2. The progesterone enzyme is responsible for pregnancy to continue.  
.....
3. Reproduction by tuber happens in orange and bitter orange.  
.....
4. The ovum is a mobile cell, of a relatively large size.  
.....

## 3 Extract the unsuitable word, then write the relation between the rest of the words :

1. Sepals / Petals / Tubers / Crapels.  
.....
2. AIDS / Gonorrhea / Syphilis / Measles.  
.....

## 4 Give reasons for each of the following :

1. Man can't reproduce asexually.  
.....  
.....
2. The petals of corolla are colourful and scented.  
.....  
.....

## 5 What's meant by each of the following ...?

1. The sperm carries half of the genetic material of the species.  
.....  
.....



## PART

## 1

2. Tissue culture of a carrot plant.

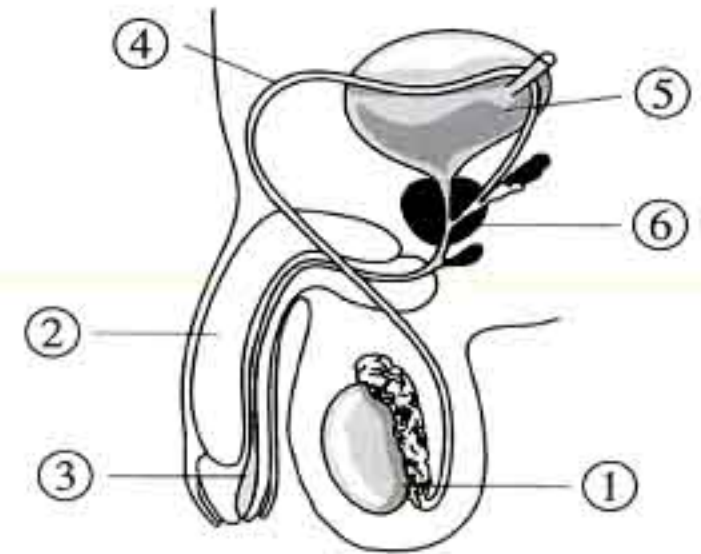
.....

.....

6 Study the opposite figure, which represents the male genital system, then answer the following :

1. Replace the numbers with the suitable labels.

- |         |         |
|---------|---------|
| ① ..... | ② ..... |
| ③ ..... | ④ ..... |
| ⑤ ..... | ⑥ ..... |



2. Write the number of the part, in which :

- |   |         |
|---|---------|
| (a) Sperms are produced.                          | (.....) |
| (b) Secretion of semen.                           | (.....) |
| (c) Transfer sperms from the testes to the penis. | (.....) |

7 Draw an illustration showing the structure of the female human ovum.

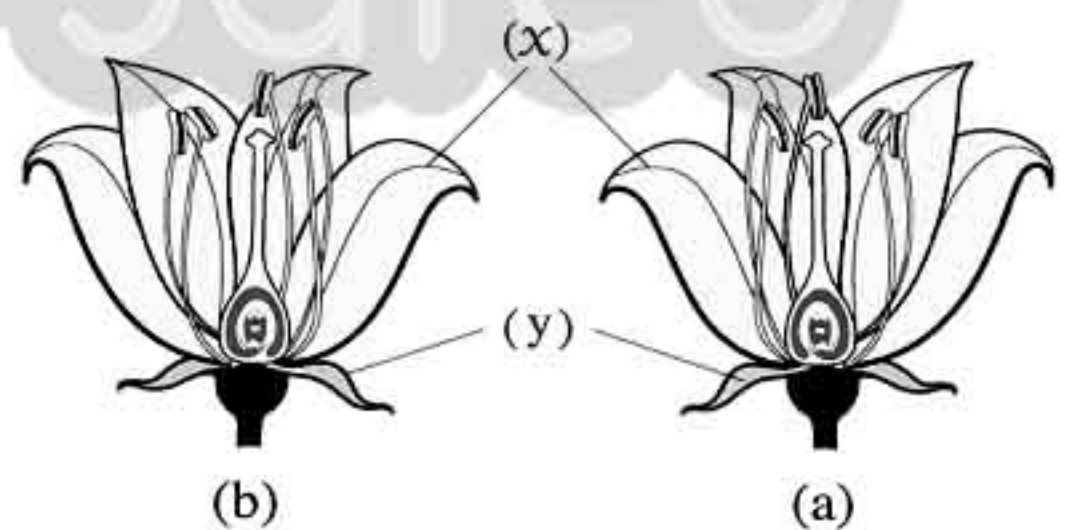
8 The opposite figure shows two flowers of two plants of the same species :

1. What's the function of the parts x and y ?

.....

.....

.....



2. Pollen grains from the flower (a) are transferred to the ova in flower (b) :

(a) What's the type of pollination that happened ?

.....

(b) What's the sex of flower (a) ?

.....



## Model Exams

## on Unit THREE

## Model Exam

1

20

Answer the following questions :

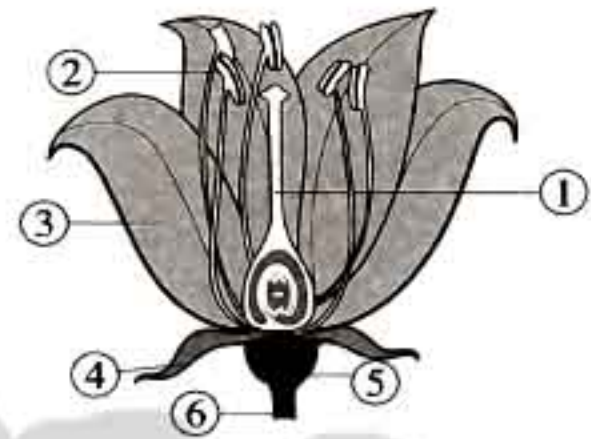
## Question

1

5 marks

A Study the following figure, then label it :

- |         |         |
|---------|---------|
| ① ..... | ② ..... |
| ③ ..... | ④ ..... |
| ⑤ ..... | ⑥ ..... |



B Complete the following :

1. Prostate gland and ..... glands are from glands associated with the ..... genital system.
2. The human zygote results from the fusion of ..... and ..... and it contains ..... chromosomes.
3. .... is a short stem where the leaves developed and modified into ..... organs.

## Question

2

5 marks

Put (✓) or (✗) :

1. The oval shaped gland in male reproductive system produces male gametes. ( )
2. Sepals, petals and tubers are from the parts of the flower. ( )
3. AIDS, gonorrhea and prostate cancer are from sexually transmitted diseases. ( )
4. The progesterone hormone is responsible for pregnancy to take place and continue. ( )
5. The ovary after fertilization forms the seed. ( )

## Question

3

5 marks

Mention an example on :

1. Typical flower.

.....

2. A hormone is secreted by the ovary.

.....



## PART

## 1

3. A disease which doesn't arise from sexual contact.

4. A plant, the type of reproduction in it is the reproduction by tubers.

5. A fruit contains a single seed.

## Question

4

5 marks

## A What is the organ which is responsible for ...?

1. The protection of the reproductive organs in the flower.

(.....)

2. The nourishment of the fetus during pregnancy.

(.....)

3. The receiving of the ripe ovum and directing it towards the uterus.

(.....)

## B Mention one difference between :

1. The calyx and the corolla.

2. The seed and the fruit.

## Model Exam

2

20

Answer the following questions :

## Question

1

5 marks

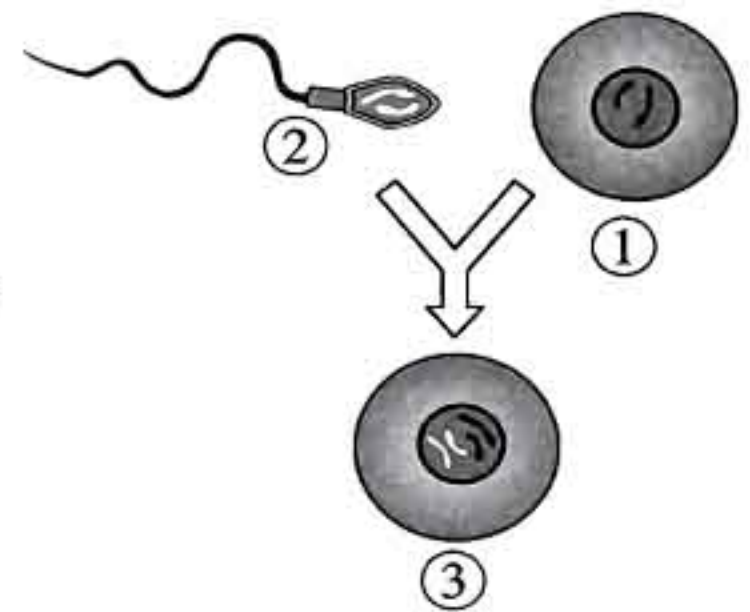
## A Study the opposite figure, which represents one of the processes which is very important in the reproduction in human then answer to the following questions :

1. What is the name of the process which is represented by this figure ?

2. What are the number of chromosomes in (2) and (3) ?

(2) .....

(3) .....





**B** Determine, the number of ripe ova that an adult women can produce during 35 years ?

.....

.....

.....

**Question 2** 5 marks

**A** Complete :

1. After....., the ovary develops forming the .....
2. The appearance of an ..... at the tip of the penis in male is due to syphilis infection.
3. Androecium is very important for .....

**B** Mention the associated glands which connected to the male reproductive system and their functions :

- The associated glands are :

1. ....
2. ....
3. ....

- Their function is :

.....

.....

.....

**Question 3** 5 marks

The opposite figure represents the female genital system.

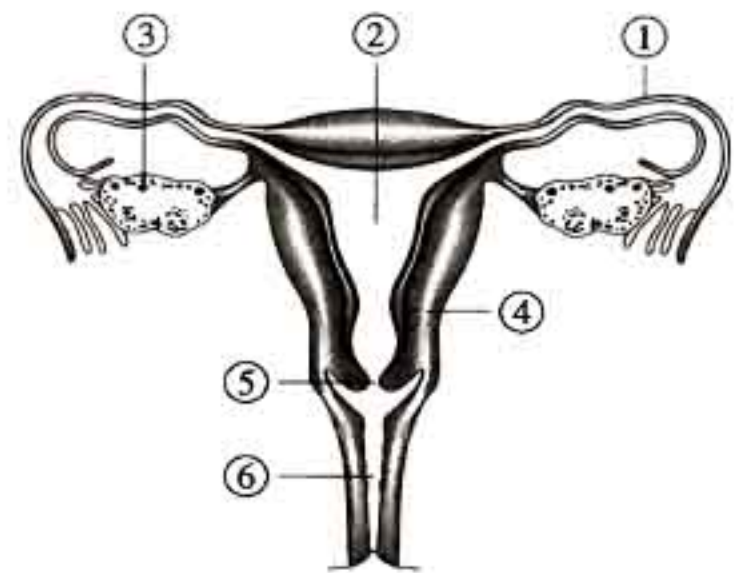
Answer the following questions :

1. Replace the numbers presented on the figure by suitable labels.

- |         |         |
|---------|---------|
| ① ..... | ② ..... |
| ③ ..... | ④ ..... |
| ⑤ ..... | ⑥ ..... |

2. What is the function of organ number ... ?

- |         |
|---------|
| ① ..... |
| ③ ..... |
| ⑥ ..... |





PART

1

Question

4

5 marks

Write what is the thing which is represented by each of the following figures, and label each of them :

Figure (1)

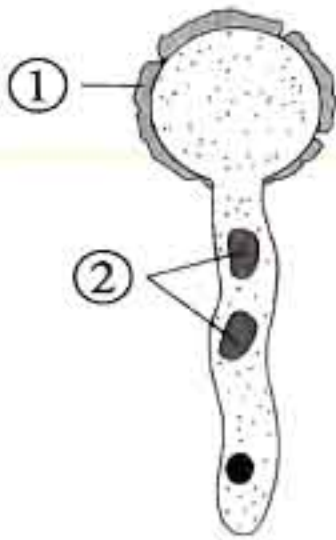


Figure (2)

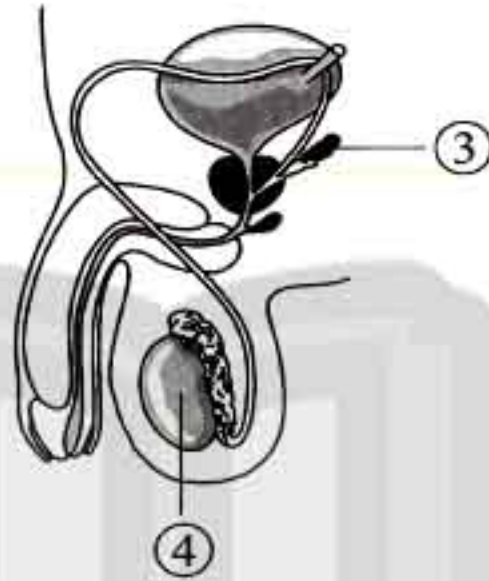


Figure (3)



Fig. (1) represents .....

Fig. (2) represents .....

Fig. (3) represents .....

No. (1) represents .....

No. (2) represents .....

No. (3) represents .....

No. (4) represents .....

No. (5) represents .....

No. (6) represents .....



## Final Revision

PART  
2**Final Revision :**

Unit One : Periodic Motion.

Unit Two : Sound and Light.

Unit Three : Reproduction and Continuity of Species.



## Final Revision on Unit

1

1

## Definitions (or scientific terms) :

|                                       |   |
|---------------------------------------|---|
| 1. Periodic motion :                  | It is a motion which is regularly repeated in equal periods of time.  |
| 2. Oscillatory motion :               | It is the motion of the oscillating body around its rest point, where the motion is repeated through equal intervals of time.   |
| 3. Amplitude :                        | It is the maximum displacement done by the oscillating body away from its rest position.  |
| 4. Complete oscillation (vibration) : | It is the motion of an oscillating body when it passes by a fixed point on its path two successive times in the same direction. |
| 5. Periodic time (T) :                | It is the time taken by an oscillating body to make one complete oscillation.   |
| 6. Frequency (F) :                    | It is the number of complete oscillations made by an oscillating body in one second.  |
| 7. The wave :                         | It is the disturbance that propagates and transfers energy in the direction of propagation.                                     |
| 8. Wave motion :                      | It is the motion produced as a result of the vibration of the medium particles at a certain moment and in a definite direction. |
| 9. The line of wave propagation :     | It is the direction through which the wave propagates.  |
| 10. Mechanical waves :                | They are waves which need a medium to propagate and can't propagate through vacuum.   |
| 11. Electromagnetic waves :           | They are waves which don't need a medium to propagate and can propagate through vacuum.   |
| 12. Transverse wave :                 | It is a disturbance in which the particles of the medium vibrate perpendicular to the direction of the wave propagation.        |
| 13. The crest :                       | It is the highest point of the particles of the medium in the transverse wave.  |
| 14. The trough :                      | It is the lowest point of the particles of the medium in the transverse wave.   |
| 15. Longitudinal wave :               | It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation.                       |
| 16. The compression :                 | It is the area in the longitudinal wave at which the particles of the medium are of highest density and pressure.               |



|   |   |
|---|---|
| 17. The rarefaction :                         | It is the area in the longitudinal wave at which the medium particles are of lowest density and pressure. |
| 18. The wavelength of the transverse wave :   | It is the distance between two successive crests or troughs.  |
| 19. The wavelength of the longitudinal wave : | It is the distance between the centres of two successive compressions or rarefactions.                    |
| 20. The amplitude of the wave :               | It is the maximum displacement achieved by the medium particles away from their rest positions.           |
| 21. Wave velocity :                           | It is the distance covered by the wave in one second.   |
| 22. Wave frequency :                          | It is the number of waves produced from the source in one second.   |
| 23. The periodic time of the wave :           | It is the time of making one wave.  |
| 24. Waves propagation law :                   | It is the relationship between the wave velocity, its frequency and the wavelength in the wave motion.    |

2

What is meant by .... ?

|   |  |
|---|--|
| 1. The amplitude of an oscillating body is 6 cm :   | The maximum displacement of the vibrating body away from its rest position is 6 cm.  |
| 2. The periodic time of an oscillating body is 0.5 sec. :   | The time taken by this oscillating body to make one complete oscillation is 0.5 sec.   |
| 3. The frequency of a simple pendulum is 60 Hz :  | The number of complete oscillations made by this simple pendulum in one second is 60 oscillations.                                 |
| 4. The time taken by a spring to make 60 complete oscillations is 1 minute :                                    | The frequency of this spring is $(\frac{60}{1 \times 60})$ which equals 1 Hz.  |
| 5. The number of complete oscillations made by an oscillating body in 10 seconds is 500 complete oscillations : | The frequency of the oscillating body is 50 Hz.<br>Or the periodic time of the oscillating body is 0.02 sec.                       |
| 6. The wavelength of a transverse wave is 5 micrometre :  | The distance between two successive crests or two successive troughs in such wave is 5 micrometre $(5 \times 10^{-6} \text{ m})$ . |
| 7. The wavelength of a sound (longitudinal) wave is 30 cm :   | The distance between the centres of two successive compressions or two successive rarefactions in such wave is 30 cm.              |



|  |  |
|--|--|
| 8. The frequency of a longitudinal wave is 200 waves/sec. :  | The number of waves produced in one second is 200 waves.   |
| 9. The distance that is covered by a visible light wave in two seconds is $6 \times 10^8$ metres : | The velocity of the visible light wave is $3 \times 10^8$ m/sec.   |
| 10. Velocity of light is 300000 km/sec. :  | The distance that is covered by a light wave in one second is 300000 km.   |
| 11. Velocity of sound is 340 m/sec. :  | The distance that is covered by a sound wave in one second is 340 m.   |
| 12. The distance covered by radio waves through air in one minute is $1.8 \times 10^{10}$ m.       | The velocity of radio waves through air is $(\frac{1.8 \times 10^{10}}{60})$ which equals $3 \times 10^8$ m/sec. |
| 13. The distance covered by a water wave in 1 minute is $9 \times 10^4$ .                          | The velocity of water wave is $(\frac{9 \times 10^4}{60})$ which equals 1500 m/sec.                              |

## 3

## Measuring units

| Physical quantity             | Measuring unit  |
|-------------------------------|---|
| 1. Amplitude :                | Metre (m) or centimetre (cm.)   |
| 2. Periodic time (T) :        | Second (sec.)   |
| 3. Frequency (F) :            | Hertz (Hz), Kilohertz, Megahertz, Gigahertz<br>KHz = $1 \times 10^3$ Hz , MHz = $1 \times 10^6$ Hz , GHz = $1 \times 10^9$ Hz       |
| 4. Wavelength ( $\lambda$ ) : | Metre (m), Millimetre , Micrometre , Nanometre<br>mm = $1 \times 10^{-3}$ m , Mm = $1 \times 10^{-6}$ m , nm = $1 \times 10^{-9}$ m |
| 5. Wave velocity :            | Metre per second (m/sec.)   |

## 4

## Important laws (mathematical relations) and solved problems :

## 1 Oscillatory motion :

- Kinetic energy =  $\frac{1}{2}$  (mass  $\times$  squared velocity) =  $\frac{1}{2} mv^2$
- Amplitude =  $\frac{1}{4}$  Complete vibration (m)



## Final Revision

• The periodic time (T) =  $\frac{\text{Time in seconds}}{\text{Number of complete oscillations made in that time}}$  (sec.)

• The time of amplitude =  $\frac{1}{4}$  the periodic time.

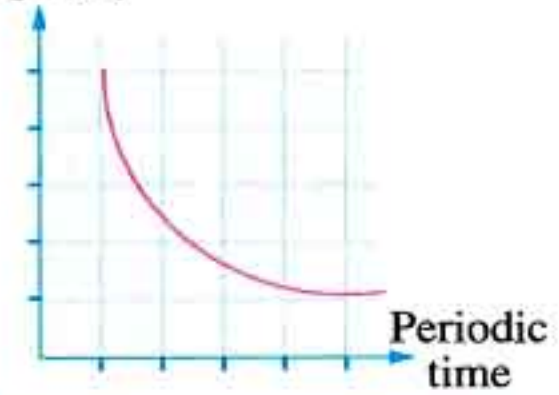
• The frequency (F) =  $\frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$  (Hz)

$$\text{Frequency (F)} = \frac{1}{\text{Periodic time (T)}}$$

&

$$\text{Periodic time (T)} = \frac{1}{\text{Frequency (F)}}$$

Frequency



"The frequency is inversely proportional to the periodic time and vice versa"

**Problem 1** The opposite figure represents a simple pendulum takes 0.4 of second to make 2 complete oscillations, calculate :

a. Amplitude. b. Periodic time. c. The time of amplitude. d. Frequency.

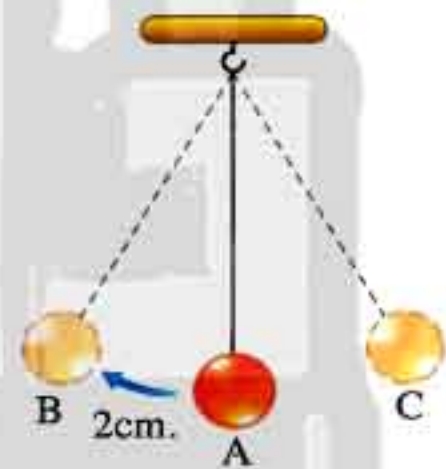
### Solution

a. Amplitude = 2 cm. = 0.02 m.

b. Periodic time (T) =  $\frac{\text{Time in seconds}}{\text{No. of complete oscillations}} = \frac{0.4}{2} = \frac{1}{5}$  sec.

c. The time of amplitude =  $\frac{1}{4}$  periodic time  
 $= \frac{1}{4} \times \frac{1}{5} = 0.05$  sec.

d. Frequency (F) =  $\frac{\text{No. of complete oscillations}}{\text{Time in seconds}} = \frac{2}{0.4} = 5$  Hz



**Problem 2** Calculate the frequency of an oscillating body in kilohertz if its periodic time is 0.2 sec.

### Solution

$$\begin{aligned} \text{Frequency (F)} &= \frac{1}{\text{Periodic time (T)}} = \frac{1}{0.2} = 5 \text{ Hz} \\ &= \frac{5}{1 \times 10^3} = 5 \times 10^{-3} \text{ KHz} \end{aligned}$$

## 2 Wave motion :

### Wavelength ( $\lambda$ ) :

1. Wavelength of a transverse wave = 2  $\times$  the horizontal distance between the successive crest and trough.



## PART

## 2

2. Wavelength of a longitudinal wave =  $2 \times$  the distance between the centre of the successive compression and rarefaction.

3. Wavelength =  $\frac{\text{The distance which covered by waves}}{\text{Number of waves}}$

**Problem 1** Determine the wavelength for the following :

1. A transverse wave, the distance between its successive crest and trough = 5 metre.
2. A longitudinal wave, the distance between its first compression and third compression = 15 metre.

**Solution**

1. Wavelength =  $2 \times$  the horizontal distance between the successive crest and trough  
 $= 2 \times 5 = 10$  metre

2. Number of waves = 2

Wavelength =  $\frac{\text{The distance which covered by waves}}{\text{Number of waves}} = \frac{15}{2} = 7.5$  metre

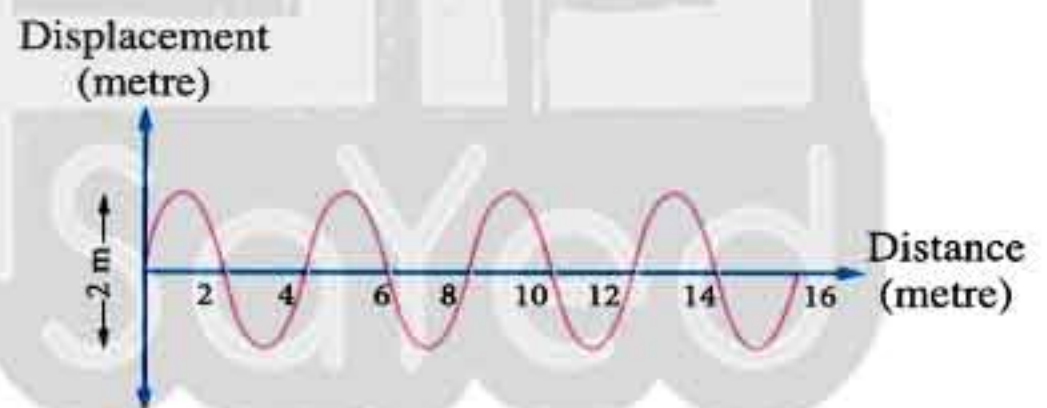
**Amplitude :**

$\therefore$  The vertical distance between the crest and the trough of a wave =  $2 \times$  Amplitude

$\therefore$  Amplitude =  $\frac{\text{The vertical distance between the crest and the trough of a wave}}{2}$

**Problem 2** From the opposite figure, determine :

1. Amplitude.
2. Wavelength.

**Solution**

1. Amplitude =  $\frac{\text{The vertical distance between the crest and the trough of a wave}}{2}$   
 $= \frac{2}{2} = 1$  metre.

2. Wavelength =  $\frac{\text{The distance covered by waves}}{\text{Number of waves}}$   
 $= \frac{16}{4} = 4$  metre.

• Wave frequency (F) =  $\frac{\text{No. of waves produced}}{\text{Time in seconds}}$  (Hz)

• Periodic time (T) =  $\frac{1}{\text{Frequency (F)}}$  (sec.)

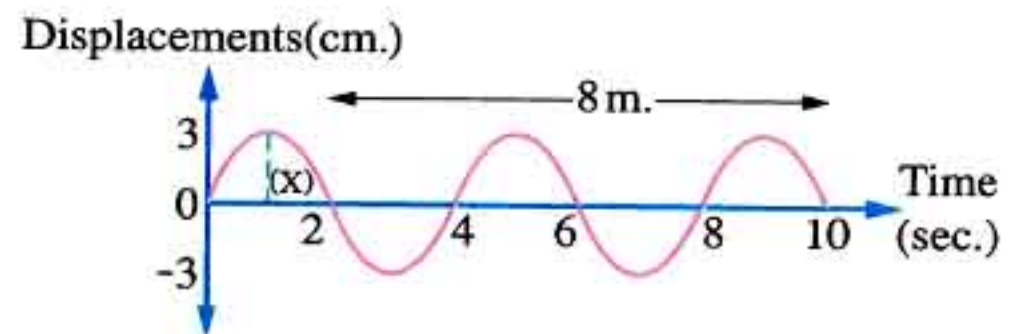
• Wave velocity (V) =  $\frac{\text{Distance covered by the wave (m)}}{\text{Time (seconds)}}$  (m/sec.)



## Final Revision

**Problem 3** From the opposite figure of a water wave, calculate :

- Amplitude of the wave.
- Periodic time.
- Wave frequency.
- Wavelength.
- Wave velocity.



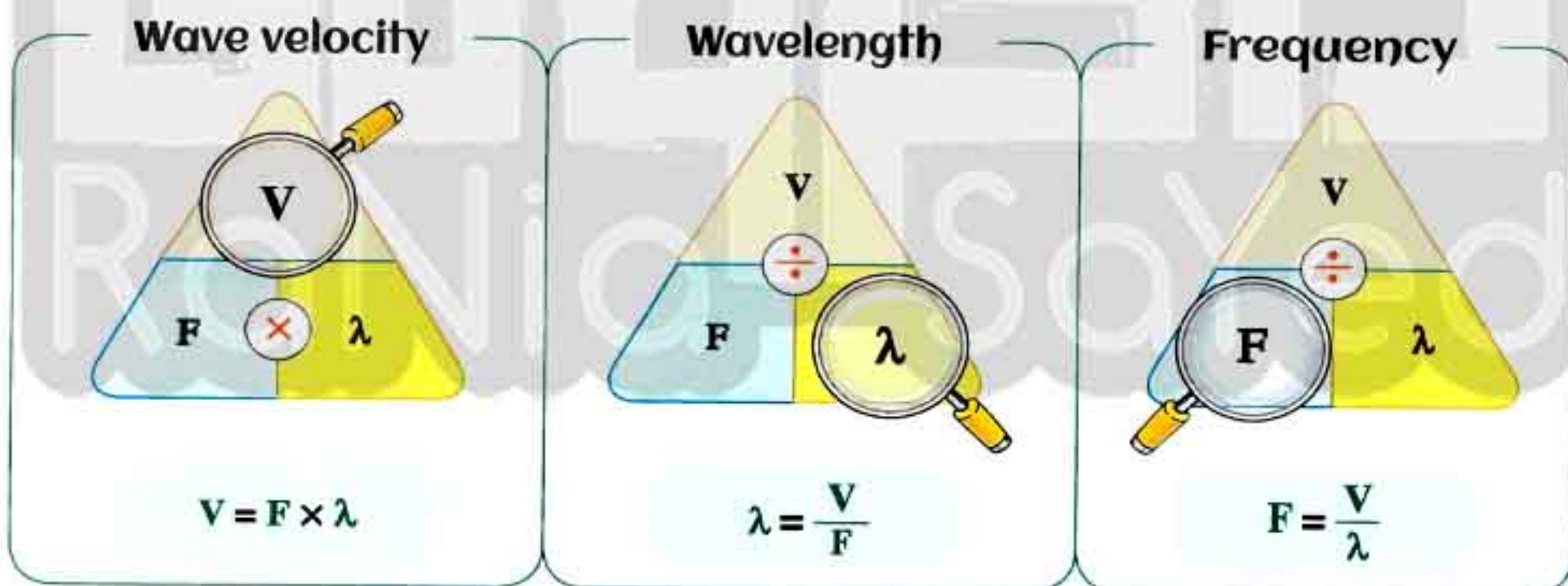
### Solution

- Amplitude (X) = 3 cm.
- Periodic time (T) (Time of one oscillation) = 4 sec.
- Frequency (F) =  $\frac{1}{\text{Periodic time (T)}} = \frac{1}{4} = 0.25 \text{ Hz}$
- Wavelength =  $\frac{8}{2} = 4 \text{ m.}$
- Wave velocity =  $\frac{\text{Distance covered by the wave}}{\text{Time}} = \frac{8}{8} = 1 \text{ m/sec.}$

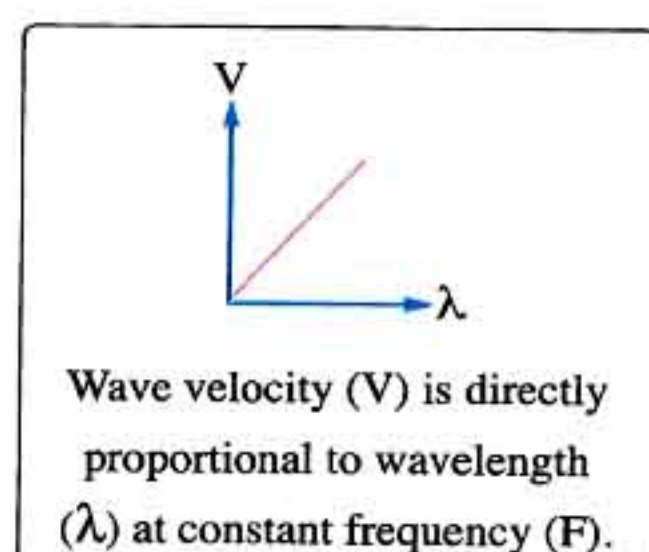
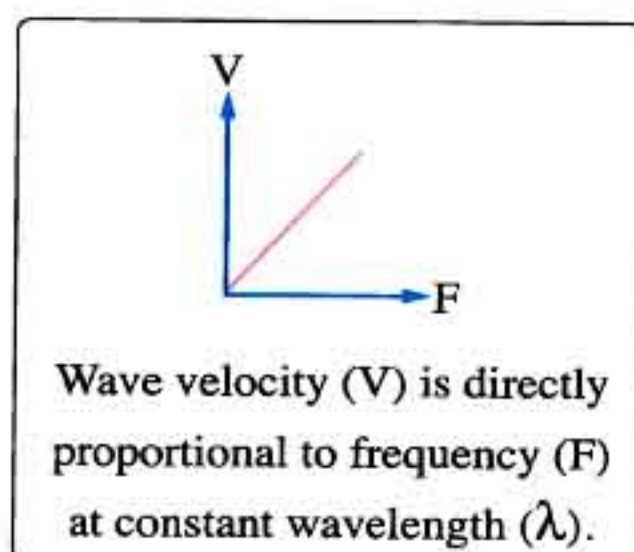
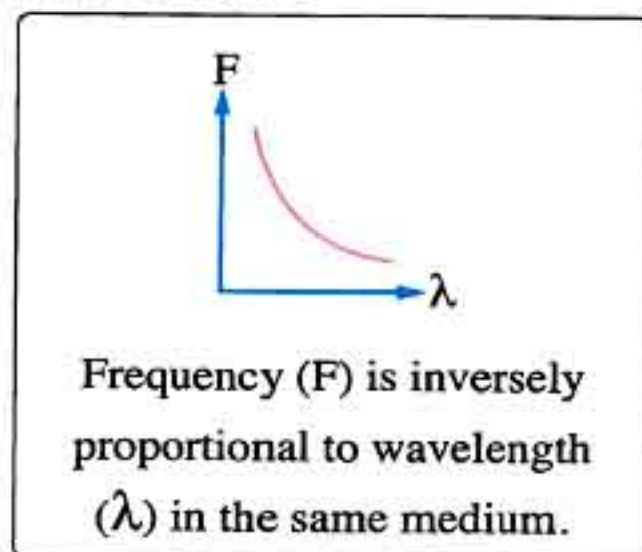
### 3 Law of wave propagation :



#### To calculate



#### Notice that :





**Problem** Calculate the wavelength in metre for a visible light wave of frequency  $5 \times 10^8$  megahertz and velocity  $3 \times 10^8$  m/sec.

**Solution**

$$\text{Frequency (F)} = 5 \times 10^8 \times 10^6 = 5 \times 10^{14} \text{ Hz}$$

$$\text{Wavelength } (\lambda) = \frac{\text{Wave velocity (V)}}{\text{Wave frequency (F)}} = \frac{3 \times 10^8}{5 \times 10^{14}} = 0.6 \times 10^{-6} = 6000 \times 10^{-10} \text{ metre}$$

5

**Give reasons for :**

- The oscillatory motion (or wave motion) is considered as a periodic motion.
  - The motion of planets around the Sun is considered as a periodic motion.
 

Because it is repeated regularly in equal periods of time.
- The motion of spring is considered as an oscillatory periodic motion.
 

Because it is repeated on the two sides of its rest position through equal intervals of time.
- The velocity of the body is taken as a measure of its kinetic energy.
 

Because kinetic energy =  $\frac{1}{2} \text{ mass} \times (\text{velocity})^2$
- The motion of the rotary bee is a periodic motion, but it is not an oscillatory motion.
 

It is a periodic motion because it is repeated regularly in equal time intervals, but it is not an oscillatory motion because it is not repeated on the two sides of its rest position.
- The frequency of the vibrating body decreases by increasing the periodic time.
 

Because the frequency is inversely proportional to periodic time.
- The product of frequency and periodic time equals unity.
 

Because frequency =  $\frac{1}{\text{Periodic time}}$
- When a billiard ball strikes a similar second one at rest, the second ball moves, while the first one stops.
 

Because the first ball transfers its energy to the second one which moves using this energy.
- The flame of a candle vibrates forward and backward if we put the candle in front of a loudspeaker.
 

Because the sound waves produced from the loudspeaker propagate carrying the energy in the same direction of propagation causing the vibration of the candle flame.
- Sound waves are mechanical waves, while radiowaves are electromagnetic waves.
 

Because sound waves need a medium to propagate through, while radio waves can propagate through vacuum.
- Water waves are transverse mechanical waves.
  - The waves produced due to vibration of a string are transverse mechanical waves.
 

They are transverse because the particles of the medium vibrate perpendicular to the direction of wave propagation and mechanical because they need a medium to propagate through.



**11. Sound waves are longitudinal mechanical waves.**

They are longitudinal because the particles of the medium vibrate along the direction of the wave propagation and mechanical because they need a medium to propagate through.

**12. We can't hear the sound of solar explosions occurring on the Sun, but we can see the light coming out of it.**

Because the sound is mechanical waves which can't propagate through vacuum, while the light is electromagnetic waves which can propagate through vacuum.

**13. We see lightning before hearing thunder.**

Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).

**14. The velocity of light waves equals the velocity of radiowaves, although the difference in their frequencies.**

Because the product of multiplying the frequency in the wavelength of each of them equals constant value ( $3 \times 10^8$  m/sec.).

**15. The difference in the wave velocity when a wave transfers from a medium to another.**

Due to the change which is occurred in its wave length, while its frequency still constant.

**16. Wave frequency is inversely proportional to the wavelength of the wave when it propagates in the same medium.**

Because the product of multiplying them usually equals wave velocity.

**6****What happens when ... ?****1. The oscillating body passes its rest position during its movement [concerning its velocity].**

Its velocity increases to the maximum value.

**2. Increasing the velocity of the pendulum [concerning its kinetic energy].**

Its kinetic energy increases.

**3. Number of oscillations produced by a vibrating body increases.**

The frequency of the body increases.

**4. The number of complete oscillations equals to the time taken by the vibrating body make these oscillations.**

The value of frequency equals to that of the periodic time.

**5. You throw a stone in water.**

Concentric circles propagate on the water surface.



PART  
2

6. You move the free end of a horizontal spiral spring fixed from the other end perpendicular to its axis.

The rings of the spring move up and down forming crests and troughs

7. The particles of a medium vibrate in a direction normal (perpendicular to) the direction of wave propagation.

Transverse waves are formed

8. Propagation of a wave in a medium as pulses of compressions and rarefactions [concerning the particles of the medium].

The particles of the medium propagate along the direction of propagation of the wave.

9. The distance between two successive crests of a wave is doubled.

The wavelength of the transverse wave is doubled.

10. Sound wave travels from air to water [concerning its velocity].

The velocity increases.

11. The frequency of a wave is doubled [concerning the wavelength] when the wave velocity is constant.

The wavelength decreases to its half value.

12. The frequency and velocity of wave propagation decreases to quarter [concerning the wavelength].

The wavelength doesn't change.

## 7

## Comparisons :

## 1 Oscillatory motion and wave motion :

| Points of comparison  | Oscillatory motion  | Wave motion   |
|-----------------------|---|---|
| • <b>Definition :</b> | It is the motion of the oscillating body around its rest point, where the motion is repeated through equal intervals of time. | It is the motion produced as a result of the vibration of the medium particles at a certain moment and in a definite direction. |
| • <b>Amplitude :</b>  | The maximum displacement of the oscillating body away from its rest position.   | The maximum displacement achieved by the medium particles away from their rest positions.                                       |
| • <b>Frequency :</b>  | The number of complete vibrations made by the vibrating body in one second.   | The number of waves produced by the source in one second.   |



## Final Revision

|                          |  |   |
|--------------------------|--|---|
| • <b>Periodic time :</b> | It is the time of one complete vibration.  | It is the time of one wave.   |
| • <b>Velocity :</b>      | The velocity is maximum when the oscillating body passes its rest position and decreases gradually when it goes far from it. | The velocity is constant through the same medium, but it changes from one medium to another.  |
| • <b>Examples :</b>      | <ul style="list-style-type: none"> <li>- Pendulum's motion.</li> <li>- Motion of spiral spring.</li> </ul>                   | <ul style="list-style-type: none"> <li>- Sound waves as mechanical longitudinal waves.</li> <li>- Light waves as electromagnetic transverse waves.</li> </ul> |

## 2 Mechanical and electromagnetic waves.

| Mechanical waves   | Electromagnetic waves   |
|--|---|
| <ul style="list-style-type: none"> <li>- They need a medium to propagate.</li> <li>- They do not propagate through vacuum (free space).</li> <li>- They are transverse or longitudinal waves.</li> <li>- Their velocity is relatively low.</li> </ul> <p><b>Ex. :</b></p> <ul style="list-style-type: none"> <li>• Water waves (transverse waves).</li> <li>• Sound waves (longitudinal waves).</li> </ul> | <ul style="list-style-type: none"> <li>- They do not need a medium to propagate.</li> <li>- They propagate through vacuum (free space).</li> <li>- They are transverse waves only.</li> <li>- Their velocity is great (<math>3 \times 10^8</math> m/sec.).</li> </ul> <p><b>Ex. :</b></p> <ul style="list-style-type: none"> <li>• Light waves.</li> <li>• Infrared waves.</li> <li>• Radiowaves (used in radars).</li> </ul> |

## 3 Transverse wave and longitudinal wave.

| Points of comparison   | Transverse wave  | Longitudinal wave   |
|------------------------|--|---|
| • <b>Definition :</b>  | It is a disturbance in which the particles of the medium vibrate perpendicular to the direction of wave propagation. | It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation. |
| • <b>Composition :</b> | Crests and troughs.  | Compressions and rarefactions.  |
| • <b>Wavelength :</b>  | It is the distance between two successive crests or troughs.   | It is the distance between the centres of two successive compressions or rarefactions.                    |
| • <b>Examples :</b>    | Water waves.   | Sound waves.  |



## PART

## 2

## 8

## Activities :



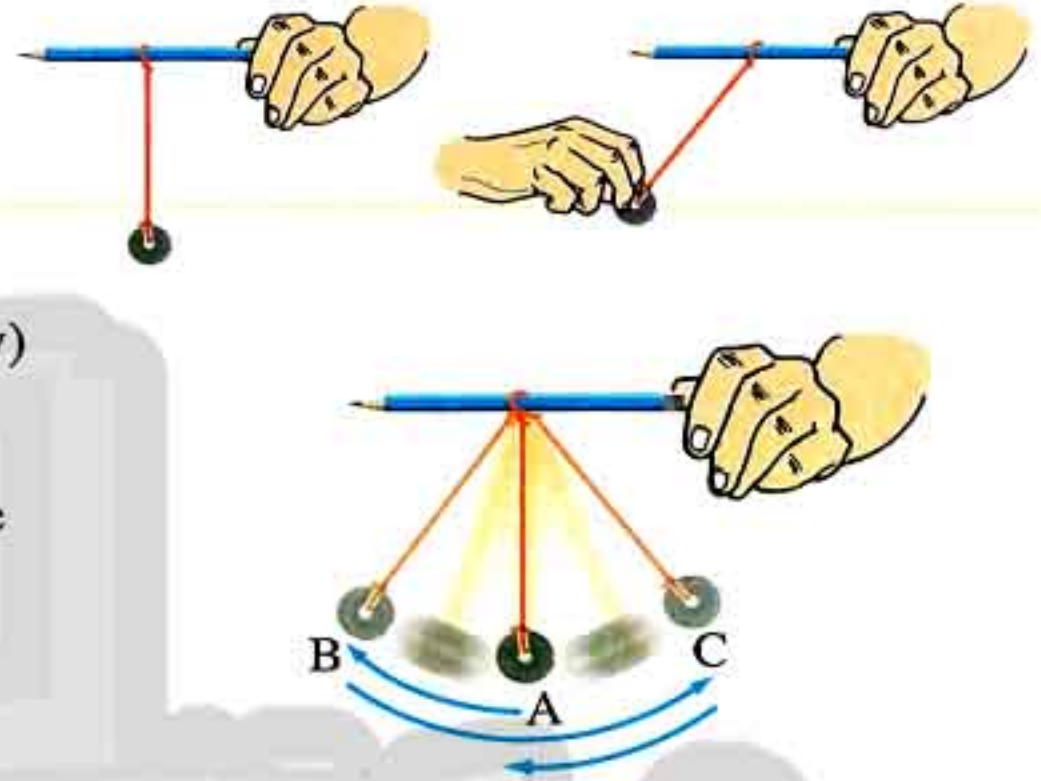
## ACTIVITY 1

To illustrate the concept of oscillatory motion.



## Steps :

1. Make a simple pendulum as shown in the figure.
2. Pull the metallic piece (the oscillating body) to the right side (B), then leave it.
3. Record the time taken by the metallic piece to repeat its movement several times.



## Observations :

1. The oscillating body moves on both sides around its rest position (A). This motion is repeated in equal time intervals.
2. The displacements of the oscillating body around its rest position are equal.
3. The velocity of the oscillating body reaches its maximum value when it passes its rest position and decreases gradually when it goes far from it.



## Conclusion :

The motion of the oscillating body around its rest position, where the motion is repeated through equal intervals of time is known as "oscillatory motion".



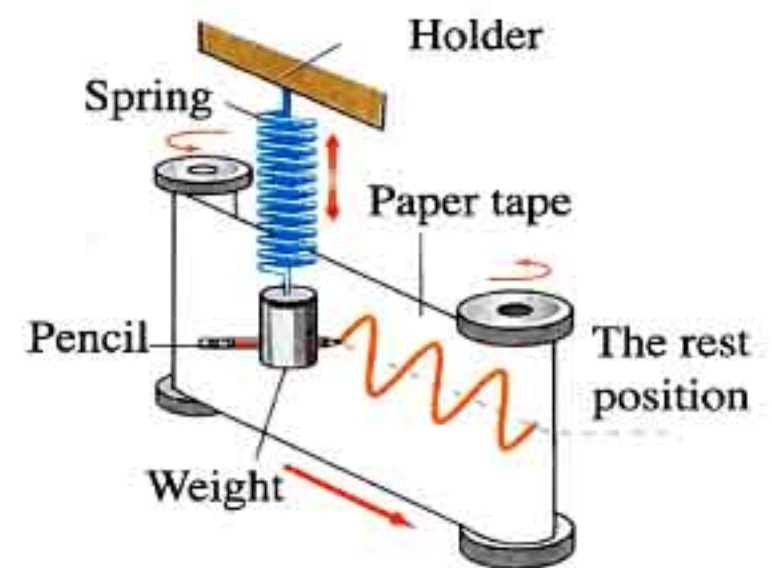
## ACTIVITY 2

To show the graphical representation of the oscillatory motion.



## Steps :

1. Fix the pencil to the weight, then tie it at one end of the spring.
2. Tie the other end of the spring at the holder, so that the pencil's tip touches the midpoint of the paper tape (as shown in the fig.).
3. Roll the paper tape regularly, then pull the weight downwards and leave it.





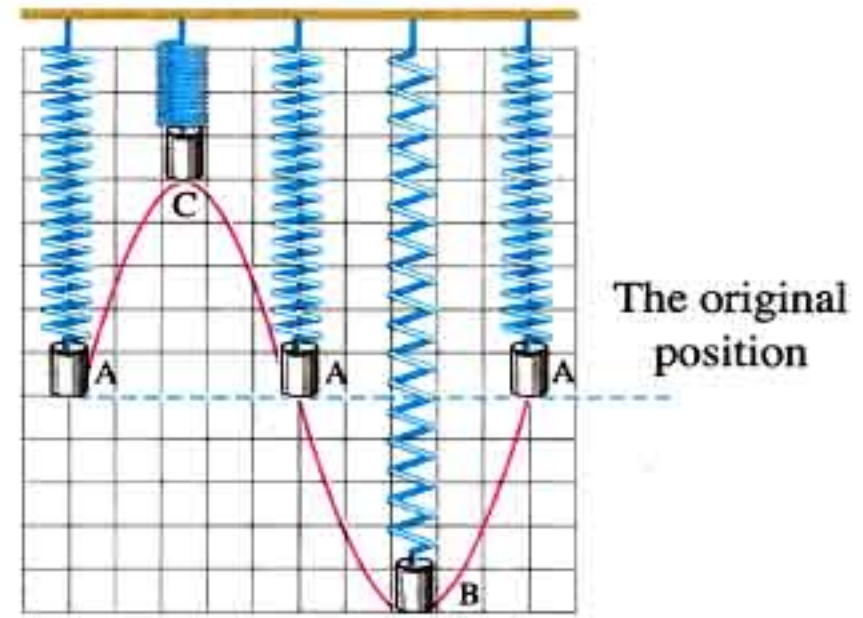
## Final Revision

**Observation :**

The pencil draws the shape of the oscillatory motion on the paper tape as shown in the figure.

**Conclusion :**

The simple harmonic motion is considered as the simplest form of oscillatory motion.



Graphical representation of oscillatory motion (Simple harmonic motion)

**ACTIVITY 3**

To illustrate the concept of wave and its role in energy transfer.

**Steps :**

1. Arrange the domino's pieces in a row at equal distances from each other.
2. Push the first piece.

**Observation :**

The pieces fall one after the other, as well as they don't change their positions after falling.

**Explanations :**

1. When the first domino piece falls, it will transfer its energy to the second piece which falls transferring its energy to the third one and so on.
2. The transfer of energy continues and the pieces don't change their positions in the row.

**Conclusion :**

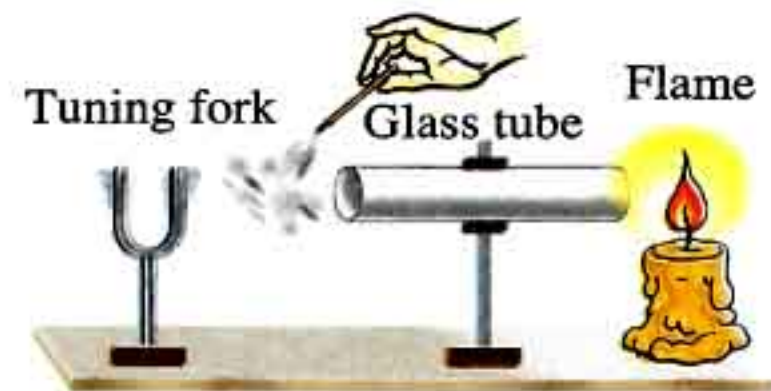
The disturbance that propagates and transfers energy in the direction of propagation is known as "the wave".

**ACTIVITY 4**

- To conclude the concept of wave motion.
- To show that the particles of the medium don't move in the waves propagation direction.

**Steps :**

1. Fix horizontally a glass tube and put a burning candle at one end of it.
2. Tab a tuning fork and let it vibrates at the other end of the tube near a burning incense stick.





## PART

## 2

**Observations :**

1. The flame of the candle vibrates.
2. The vapour of burning incense stick does not enter the tube.

**Explanations :**

1. Sound energy is generated when the tuning fork vibrates. This energy is transferred to the flame of the candle in the form of sound waves.
2. The medium particles (air and smoke particles) do not move from their places during the propagation of sound waves.

**Conclusion :**

The movement resulting from the vibration of the medium particles at a certain moment in a specific direction is known as “**wave motion**”.

**ACTIVITY 5**

To show the nature of transverse waves.

**Steps :**

1. Fix one end of a spring to a wall using the nail.
2. Tie a coloured tape in the middle of the spring.
3. Move the free end of the spring up and down perpendicular to the axis of the spring.

**Observations :**

1. The rings of the spring (which represent the wave propagation) move up and down.
2. The coloured tape (which represents the particles of the medium) vibrates up and down without transferring from its place.

**Conclusions :**

1. During the wave propagation, the medium particles don't move from their positions, but they vibrate around their rest positions.
2. The disturbance in which the particles of the medium vibrate perpendicular to the direction of wave propagation is known as “**transverse wave**”.





## ACTIVITY 6

To show the nature of longitudinal waves.



### Steps :

1. Fix one end of a spring to a wall using the nail.
2. Tie a coloured tape in the middle of the spring.
3. Push and pull the coil rings from the left to the right.



### Observations :

1. The rings of the spring (which represent the wave propagation) are too close to each other in some areas and they are faraway from each other in other areas.
2. The coloured tape vibrates around its rest position without transferring from its place.



### Conclusions :

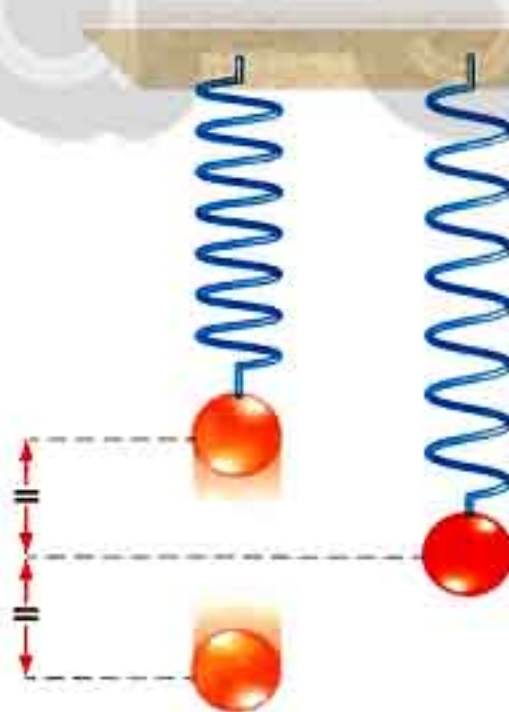
1. During the wave propagation, the medium particles don't move from their rest positions but they vibrate around their rest positions.
2. The disturbance in which the particles of the medium vibrate along the direction of wave propagation is known as "longitudinal wave".

## 9

### Important drawings :

#### 1 The oscillatory motion of the spring :

1  
The motion is regularly repeated in equal periods of time at the two sides of its rest position.



2  
The velocity of the oscillating body is very high when it passes its rest position.

3  
The velocity of the oscillating body is decreases when it goes far from its rest position until it reaches zero at the maximum displacement.

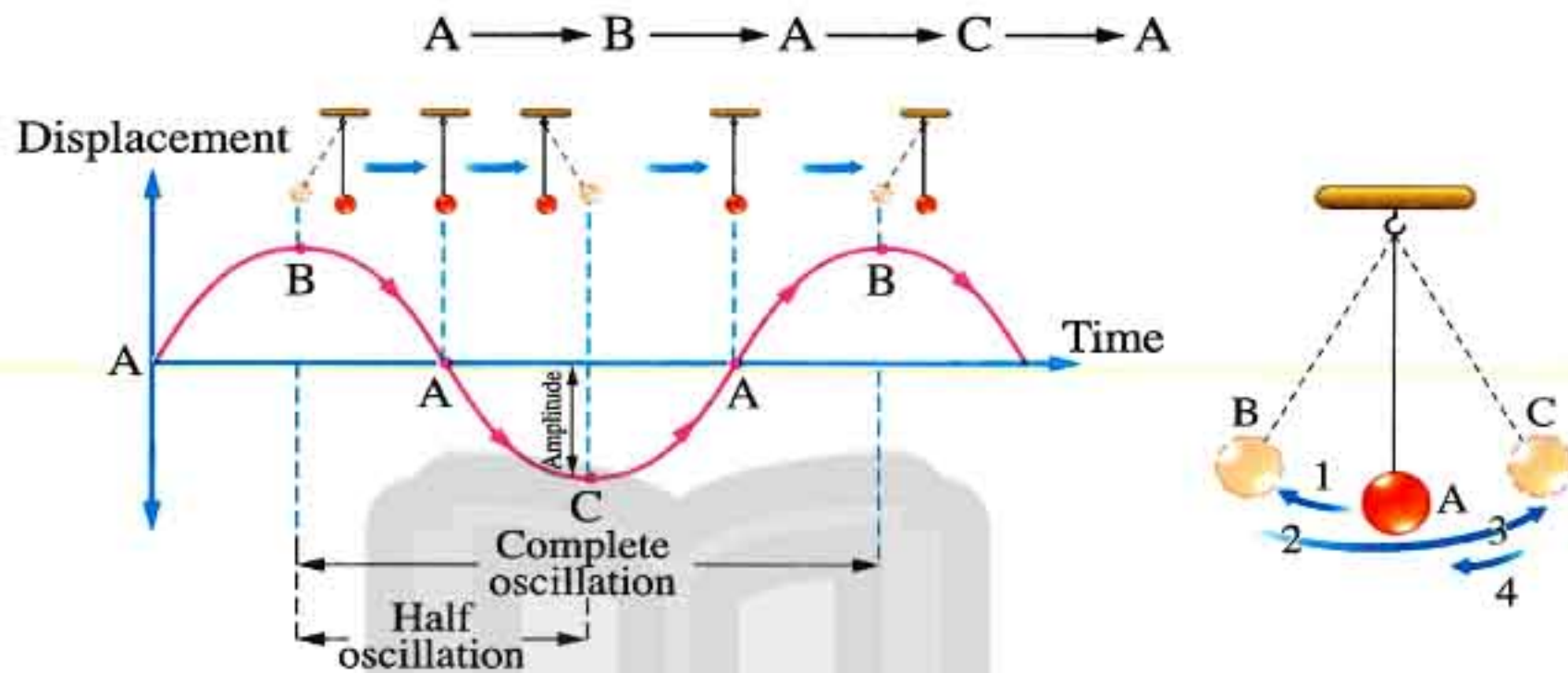


## PART

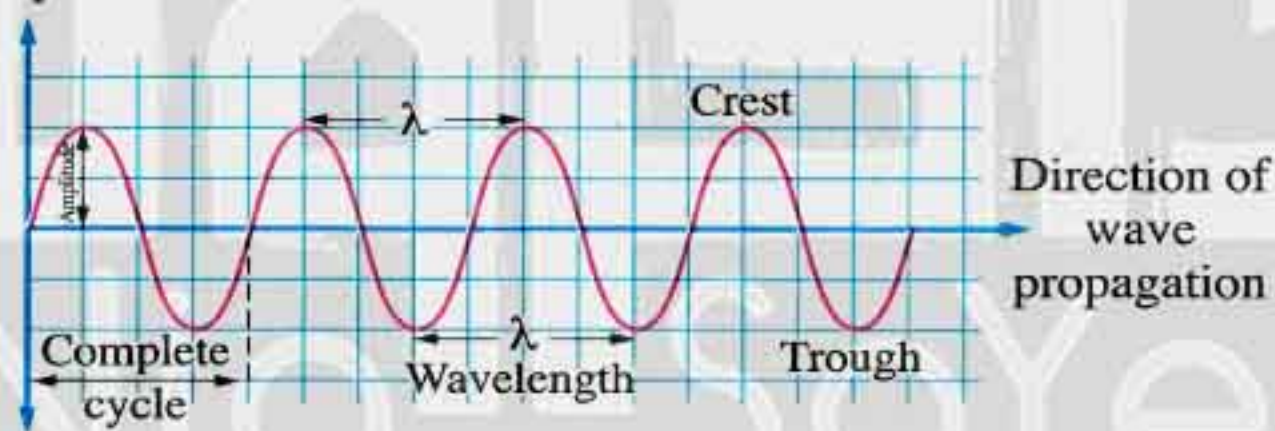
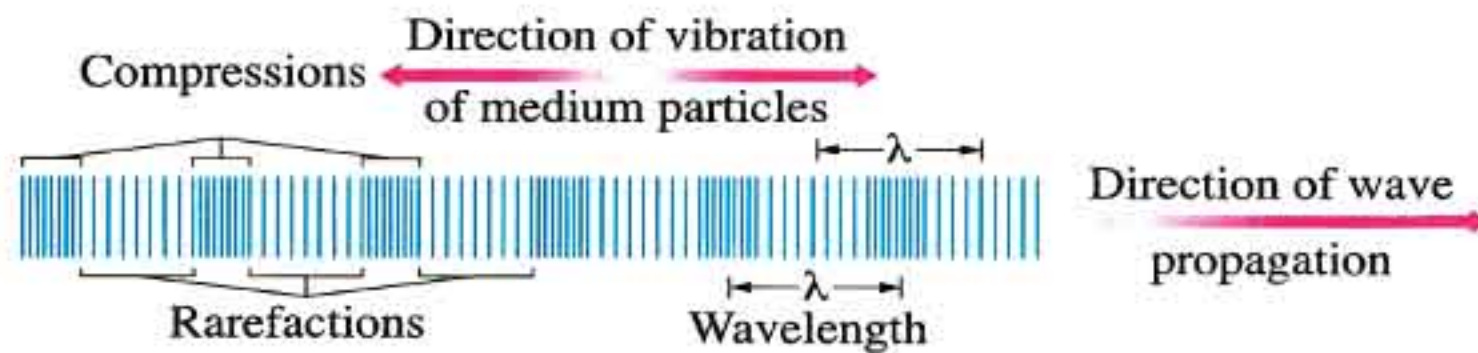
## 2

**2 Simple pendulum :**

The complete oscillation includes four amplitudes (displacements)

**3 Transverse wave :**

Direction of vibration of medium particles

**4 Longitudinal wave :**



## Final Revision on Unit

2

1

## Definitions (or scientific terms) :

|                                      |   |
|--------------------------------------|---|
| 1. Sound :                           | It is an external factor that affects the ear causing the sense of hearing.   |
| 2. Sound velocity:                   | It is the distance which is covered by the sound waves in one second.   |
| 3. Musical tones :                   | They are tones of uniform frequency and comfortable to be heard.  |
| 4. Noise :                           | It is sound of non-uniform frequency and uncomfortable to be heard.   |
| 5. Sound pitch :                     | It is the property by which the ear can distinguish (differentiate) between harsh and sharp voices.   |
| 6. Sound intensity :                 | It is the property by which the ear can distinguish (differentiate) between strong and weak sounds.   |
| 7. Noise intensity :                 | It is the level of sound intensity.   |
| 8. The inverse square law of sound : | The intensity of sound at a point is inversely proportional to the square of the distance between that point and the sound source. $[I \propto \frac{1}{d^2}]$                          |
| 9. Sound quality (type) :            | It is the property by which the human ear can distinguish (differentiate) between different sounds according to the nature of the source even if they are equal in intensity and pitch. |
| 10. Harmonic tones :                 | They are tones that accompany the fundamental (basic) tone, but they are lower in intensity and higher in pitch and differ from one instrument to another.                              |
| 11. Sonic waves :                    | They are sound waves of frequencies ranging from 20 to 20000 Hz (20 KHz).   |
| 12. Infrasonic waves :               | They are sound waves of frequencies less than 20 Hz.  |
| 13. Ultrasonic waves :               | They are sound waves of frequencies higher than 20000 Hz (20 KHz).  |
| 14. Light :                          | It is an external factor (or stimulus) that affects the eye causing the sense of vision.  |
| 15. The visible light :              | It is electromagnetic waves their wavelength range between 380 : 700 nanometres.  |
| 16. Speed of light :                 | It is the distance which is covered by light in one second.   |
| 17. Analysis of white light :        | It is the splitting of white light into seven spectrum colours.   |
| 18. Transparent medium :             | It is the medium which permits most light to pass through.  |
| 19. Translucent medium :             | It is the medium which permits only a part of light to pass through and absorbs the remaining part.   |



|   |   |
|---|---|
| 20. Opaque medium :                         | It is the medium that doesn't permit light to pass through.   |
| 21. Light intensity :                       | It is the quantity of light falling perpendicular to a unit area of a surface in one second.  |
| 22. The inverse square law of light :       | The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light.   |
| 23. Light reflection :                      | It is the rebounding of light waves in the same medium on meeting a reflecting surface.   |
| 24. Reflecting surface for light :          | It is a smooth or rough surface at which the reflection of light takes place.   |
| 25. Regular (uniform) reflection :          | It is the reflection of light rays when they meet (fall on) a smooth (uniform) and glistening reflecting surface, where the incident light rays are reflected in one direction.     |
| 26. Irregular (non-uniform) reflection :    | It is the reflection of light rays when they meet (fall on) a rough (non-uniform) reflecting surface, where the incident light rays are reflected in different directions.          |
| 27. The incident light ray :                | It is a narrow light beam which is represented by a straight line, it intersects with the reflecting surface at the point of incidence.   |
| 28. The reflected light ray :               | It is a narrow light beam which is represented by a straight line, it is reflected from the reflecting surface at the point of incidence.   |
| 29. Angle of incidence of light ray :       | It is the angle between the incident light ray and the line perpendicular to the reflecting surface (separating surface) at the point of incidence.                                 |
| 30. Angle of reflection of light ray :      | It is the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence.   |
| 31. Light refraction :                      | It is the change of light path when it travels from a transparent medium to another transparent medium of different optical density.  |
| 32. Optical density of the medium :         | It is the ability of the transparent medium to refract the light.   |
| 33. Angle of refraction :                   | It is the angle between the refracted light ray and the normal at the point of incidence on the interface.  |
| 34. Angle of emergence :                    | It is the angle between the emergent light ray and the normal at the point of emergence on the interface.   |
| 35. Absolute refractive index of a medium : | It is the ratio between the velocity of light through air to the velocity of light through another transparent medium.  |
| 36. Mirage :                                | It is a natural phenomenon that takes place on the desert roads especially in the summer times, where objects on the road sides seem as if they have inverted images on a wet area. |



2

## What is meant by ... ?

|   |  |
|---|--|
| 1. The wavelength of a sound wave is 1.5 m :              | The distance between the centres of two successive compressions or two successive rarefactions is 1.5 m.   |
| 2. Sound velocity through air is 340 m/sec. :             | The distance covered by sound waves in one second is 340 m.  |
| 3. Angle of incidence of a sound ray = $30^\circ$ :       | The angle between the incident sound ray and the line perpendicular to the reflecting surface at the point of incidence = $30^\circ$   |
| 4. Angle of reflection of a sound ray = $60^\circ$ :      | The angle between the reflected sound ray and the line perpendicular to the reflecting surface at the point of incidence = $60^\circ$  |
| 5. The velocity of light is $3 \times 10^8$ m/sec. :      | The distance covered by the light in one second is $3 \times 10^8$ m.  |
| 6. Angle of incidence of a light ray is $40^\circ$ :      | The angle between the incident light ray and the line perpendicular to the reflecting surface at the point of incidence is $40^\circ$  |
| 7. Angle of reflection of a light ray is zero :           | <ul style="list-style-type: none"> <li>The angle between the reflected light ray and the line perpendicular to the reflecting surface equals zero.</li> </ul> <b>OR</b> <ul style="list-style-type: none"> <li>The incident light ray falls perpendicular on the reflecting surface and reflects on itself.</li> </ul> |
| 8. Angle of refraction of a light ray equals $30^\circ$ : | The angle between the refracted light ray and the normal at the point of incidence on the interface equals $30^\circ$  |
| 9. Angle of emergence in a prism is $43^\circ$ :          | The angle between the emergent light ray and the line perpendicular to the interface at the point of emergence is $43^\circ$   |
| 10. Absolute refractive index of water is 1.33 :          | The ratio between the velocity of light through air to that through water is 1.33  |
| 11. The refractive index of a medium is high :            | The optical density of such medium is high.<br><b>OR</b><br>The velocity of light through such medium is small.  |

3

## Measuring units :

| Physical quantity    | Measuring unit      |
|----------------------|---------------------|
| 1. Sound velocity :  | m/sec.              |
| 2. Sound intensity : | Watt/m <sup>2</sup> |
| 3. Noise intensity : | Decibel             |

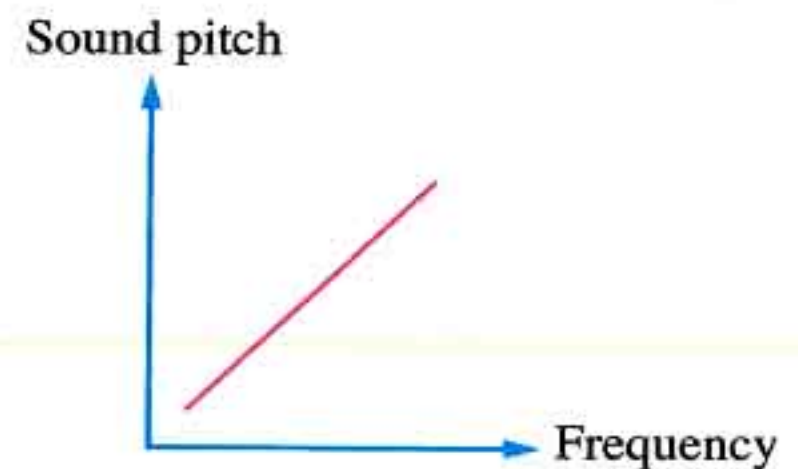


PART

2

4

## Important laws (mathematical relations) and solved problems :

1 Sound pitch  $\propto$  Frequency :Sound pitch  $\propto$  Frequency.

## 2 In Savart's wheel :

$$\text{Sound frequency (F)} = \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

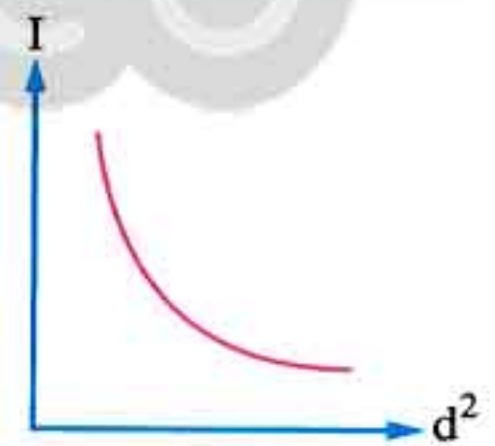
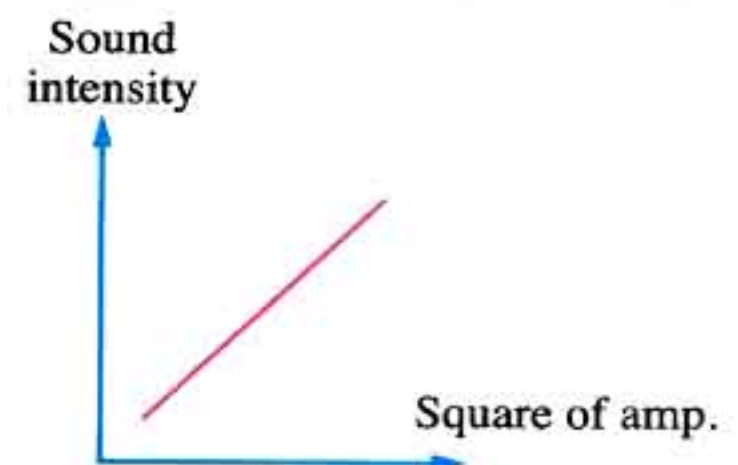
**Problem** Calculate the number of gear teeth of Savart's wheel, given that the frequency of the sound produced is 100 Hz and the wheel rotates with a rate of 30 cycles/min.

**Solution**

$$\begin{aligned} \text{Frequency (F)} &= \frac{\text{No. of rotations (d)} \times \text{No. of gear teeth (n)}}{\text{Time (in seconds) (t)}} \\ 100 &= \frac{30 \times \text{No. of gear teeth}}{60} \\ \text{No. of gear teeth} &= \frac{60 \times 100}{30} = 200 \text{ teeth} \end{aligned}$$

## 3 Inverse square law of sound :

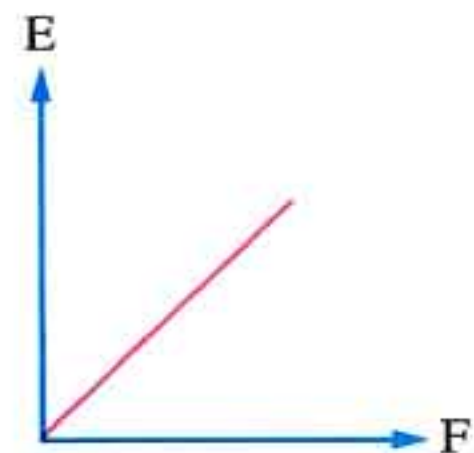
$$\text{Sound intensity (I)} \propto \frac{1}{\text{The square of the distance between the sound source and the ear (d}^2\text{)}}$$

4 Sound intensity (I)  $\propto$  the square of the amplitude (Amp<sup>2</sup>) :Sound intensity (I)  $\propto$  Square of the amplitude.



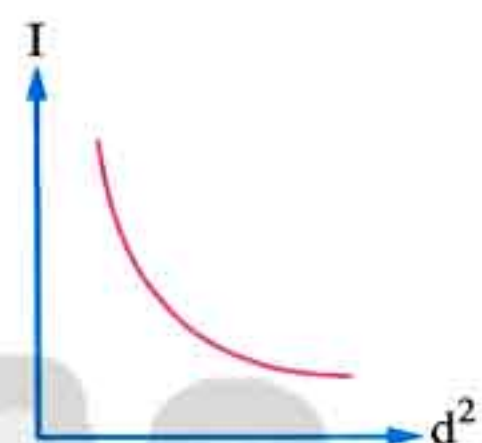
### 5 Photon energy = Planck's constant $\times$ Photon frequency

Photon energy  $\propto$  Photon frequency.



### 6 Inverse square law of light :

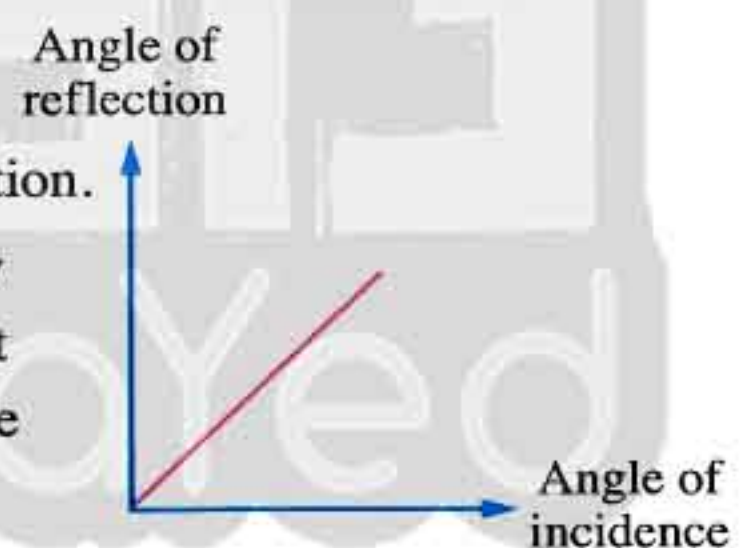
Light intensity (I)  $\propto \frac{1}{\text{The square of the distance between the surface and the source of light (d}^2\text{)}}$



### 7 The two laws of light reflection :

**First law** : The angle of incidence = the angle of reflection.

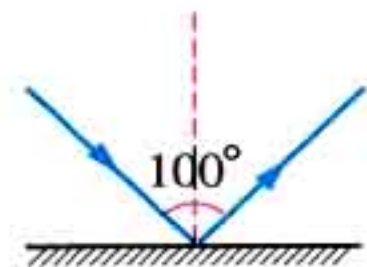
**Second law** : The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all locate in one plane perpendicular to the reflecting surface.



**Problem 1** If the angle between the incident light ray and the reflected light ray is  $100^\circ$ , find the angle of incidence and the angle of reflection.

**Solution**

$$\text{Angle of incidence} = \text{Angle of reflection} = \frac{100}{2} = 50^\circ$$



### 8 Absolute refractive index of a medium : $\frac{\text{Velocity of light through air}}{\text{Velocity of light through the medium}}$



PART  
2

**Problem 2** If the velocity of light through water is  $2.25 \times 10^8$  m/s, calculate the absolute refractive index of water. Knowing that the velocity of light through air is  $3 \times 10^8$  m/s.

**Solution**

$$\begin{aligned} \text{The absolute refractive index of water} &= \frac{\text{Velocity of light through air}}{\text{Velocity of light through water}} \\ &= \frac{3 \times 10^8}{2.25 \times 10^8} = \frac{3}{2.25} = 1.33 \end{aligned}$$

## 5

**Importance or uses :**

| The item                    | Importance or uses  |
|-----------------------------|---|
| 1. Ear plugs :              | They are used to avoid the hazards of noise in loud places.   |
| 2. Savart's wheel :         | It is used to determine the pitch (frequency) of an unknown tone.   |
| 3. Ultrasonic waves :       | <ul style="list-style-type: none"> <li>• Breaking down kidney and ureter's stones without any surgical operations.</li> <li>• Diagnosis of male prostate gland tumors and its effect on bladder.</li> <li>• Discovering malignant tumors.</li> <li>• Sterilization of food, water and milk.</li> <li>• Discovering of landmines.</li> </ul> |
| 4. Triangular glass prism : | It analysis the white light into seven spectrum colours.  |
| 5. Light :                  | <b>Light is used in home decorations like :</b> <ul style="list-style-type: none"> <li>- Spot lights to illuminate artifacts.</li> <li>- Ornamented lamps that bring happiness and joy to the place.</li> <li>- Stand lamps that concentrate light for reading.</li> </ul>  |

## 6

**Give reasons for :**

- Sound waves are mechanical longitudinal waves.**
  - They are mechanical waves because they need a medium (as air) to propagate through.
  - They are longitudinal waves because the medium particles vibrate in the same direction of wave propagation forming compressions and rarefactions.
- The explosions occurred on the Sun surface cannot be heard on the Earth.**

Because sound is mechanical waves which need a medium to propagate through.
- Sound can be heard from all surrounding directions.**

Because sound travels through air as spheres of compressions and rarefactions whose centre is the sound source.
- The violin's player changes the length of strings during his play.**

To change the frequency of the produced tone.
- The difference in frequency between the tone (note) and noise.**

Because musical note is of uniform frequency, while noise is of non-uniform frequency.



6. **The sound of drill and loudspeaker is uncomfortable to be heard.**  
Because it is sound of non-uniform frequency.
7. **Some construction workmen use ear plugs made of silicon.**  
To protect their ears from the noise.
8. **The tuning fork of frequency 251 Hz gives rougher sound than that is produced by another tuning fork of 512 Hz.**  
Because the sound of the tuning fork of frequency 251 Hz is low pitch, while that of 512 Hz is high pitch.
9. • **The intensity of sound decreases four times as the distance between the ear and sound source is doubled.**  
• **It is preferred to sit in the first rows more than sit in the back rows in lecture' classes.**  
Because the intensity of sound is inversely proportional to the square of the distance between the ear and the sound source.
10. • **The intensity of sound increases as the amplitude of the vibrating source increases.**  
• **The sound intensity which produced from a vibrating ruler will be decreased with time passes.**  
Because the sound intensity is directly proportional to the square of the amplitude of the vibrating source.
11. **The intensity of sound increases when the sound source touches a resonance box.**  
Due to the increase of the surface area of the vibrating body.
12. **The strings of a musical lute are fixed on a hollow wooden box.**  
To increase the area of the vibrating body which leads to an increase in sound intensity.
13. **Sound travelling through air has less intensity than that travelling through carbon dioxide gas but the sound intensity of firing a shot on mountain's top is more than that on the base of mountain.**  
Because the density of carbon dioxide gas is more than that of air and the density of air in mountain's top less than it on the mountain's base, since sound intensity is directly proportional to the density of the medium.
14. **Piano's sound differs from that of a violin even if they have the same intensity and pitch.**  
Due to the difference in harmonic tones that associate the fundamental tone of each of them.
15. **The human ear can hear sounds of frequencies ranging from 20 to 20000 Hz.**  
Because the ear transmits the effect of these waves to the brain which translates them into sound and audible tones.
16. **Dogs can hear all sounds produced by man.**  
Because man produces sounds of frequencies less than 20 kilohertz and dogs can hear up to 50 kHz.
17. **Man can't hear all sounds produced by dolphins.**  
Because dolphins produce sounds up to 120 kHz ,while man can hear sounds of frequencies up to 20 kHz only.



**18. Some sound waves cannot be heard by man.**

Because the frequencies of these waves are lower than 20 Hz or higher than 20000 Hz, so the human ears cannot hear them.

**19. The infrasonic waves are used for weather forecast.**

Because these waves accompany the blowing of storms that preceding rainfall.

**20. • The use of ultrasonic waves in milk sterilization.****• Ultrasonic waves are used to sterilize food and water.**

Because they have high ability to kill some types of bacteria and stop the action of some viruses.

**21. The ultrasonic waves have medical uses.**

Because they are used for breaking down of kidney and ureter's stones and also for diagnosis of male prostate tumors.

**22. Light waves are electromagnetic transverse waves.**

- They are electromagnetic waves, because they propagate through vacuum.
- They are transverse waves, because the medium particles vibrate perpendicular to the direction of the wave propagation forming crests and troughs.

**23. Light can travel through free space.**

Because it is electromagnetic waves which don't need a medium to travel through.

**24. The energy of red light photon is less than that of orange light photon.**

Because the frequency of red light photon is less than that of orange light photon.

**25. The energy of violet photon has the maximum energy in spectrum colours.**

Because it has the maximum frequency in spectrum colours.

**26. The energy of violet photon is more than that of green photon.**

Because the frequency of violet photon is more than that of green photon.

**27. Objects can be seen clearly through transparent media.**

Because transparent media permit most light to pass through.

**28. A clear glass is a transparent medium.**

Because clear glass permits most light to pass through and objects can be seen clearly through it.

**29. Although water is a transparent medium, we cannot see fish at the bottom of the River Nile.**

Because the thickness of water at that point (the bottom) is large enough to prevent light to pass through.

**30. Objects cannot be seen clearly through frosted glass.**

Because frosted glass is a translucent medium which permits only a part of light to pass through and absorbs the remaining part.



**31. A tissue paper is a translucent medium.**

Because tissue paper permits only a part of light to pass through and we can see objects through it less clearly.

**32. Aluminium foil is an opaque medium.**

Because aluminium does not permit light to pass through and objects cannot be seen through it.

**33. The inability to see the impurities present in black honey.**

Because black honey is an opaque medium.

**34. The intensity of light on a surface decreases to its quarter as the distance between the surface and light source is doubled.**

Because intensity of light is inversely proportional to the square of the distance between the surface and light source.

**35. The formation of inverted images of trees and buildings on the road when rain falls.**

Due to light reflection.

**36. A leather jacket produces irregular light reflection, while a stainless steel plate produces regular light reflection.**

Because leather jacket is a rough surface, while stainless steel plate is a smooth surface.

**37. The light ray which is incident perpendicular on a glistening surface, reflects on itself.**

Because the angle of incidence = angle of reflection = zero.

**38. The velocity of light changes from one medium to another.**

Because the optical density of a medium differs from one medium to another.

**39. The light refracts when it travels from a medium to another.**

Due to the difference of the velocity of light through the different transparent media.

**40. When a light ray travels from glass to air, the angle of refraction is larger than that of incidence.**

Because the light ray refracts far from the normal.

**41. When a light ray travels from air to water, it refracts near the normal.**

Because air is a transparent medium of lower optical density than water.

**42. When a light ray transfers from a transparent medium to another, it may not refract.**

Because the angle of incidence of the light ray may be :

- equal zero (i.e the light ray falls perpendicular to the separating surface).
- more than the critical angle. so, it will be totally reflected in the same medium.

**43. When a light ray passes through a glass prism, it refracts.**

Due to the difference of light velocity through air than that through glass.

**44. The absolute refractive index for any transparent medium is always greater than one.**

Because the velocity of light through air is always greater than that through any other transparent medium.



**45. The pencil which is partially immersed in water appears as being broken.**

Due to the refraction of light rays coming from the immersed part in water, where the eye sees the pencil on the extensions of the refracted rays, so the pencil appears as being broken.

**46. The submerged object in water is seen in an apparent position above its real position.**

Because the eye sees the object on the extensions of the refracted rays, so the submerged object is seen in an apparent position above its real one.

**47. To pick up a coin which has fallen in a beaker filled with water in its real position, we must look at it vertically.**

Because the ray which falls perpendicular to the interface passes to air without refraction, so the apparent position is the real position.

**48. The occurrence of mirage phenomenon.**

Due to refraction and reflection of light in air layers which differ in the degree of temperature.

## 7

### What happens when ... ?

**1. Both the frequency and velocity of wave propagation decrease to quarter its value [concerning the wavelength].**

The wavelength doesn't change.

**2. • You decrease the length of violin string during playing [concerning the sound pitch].**

• The number of rotations per second of Savart's wheel increases.

The pitch of the produced tone increases.

**3. • You move towards a sound source [concerning the sound intensity].**

• The quantity of sound energy falling perpendicularly in one second on a unit area increases.

• The amplitude of vibration of sound source increases [concerning the sound intensity].

• The sound direction is in the air flow direction [concerning the sound intensity].

• You put a vibrating tuning fork on a resonance box [concerning the sound intensity].

The sound intensity increases.

**4. The distance between the sound source and the ear increases twice.**

The intensity of sound decreases to its quarter value.

**5. The amplitude of a sound wave decreases to half [concerning the sound intensity].**

The sound intensity decreases to its quarter value.

**6. Operating an electric bell under a bell jar connected to a vacuum pump, then pump the air out of the jar gradually.**

The intensity of the produced sound decreases gradually until it stops.



7. The density of the medium decreases [concerning the sound intensity].  
The intensity of sound decreases.
8. • The frequency of sonic waves decreases less than 20 Hz.  
• The frequency of sonic waves increases more than 20000 Hz.  
Man cannot hear such waves.
9. • A compact disc (CD) is put such that its shiny side faces sunlight.  
• Incidence of a white light ray on one face of a triangular glass prism.  
The white light analysis and seven spectrum colours are produced.
10. The thickness of the transparent medium increases concerning the quantity of light that passes through it.  
The quantity of light that passes through it decreases.
11. Light falls on a glass cup.  
It permits most light to pass through.
12. You look at a picture through a clear glass in a window.  
The picture will be seen clearly.
13. You look at a page of a book through a frosted glass.  
The page will not be seen clearly.
14. Putting a metallic sheet in front of a light ray.  
The light will not be seen.
15. The distance between the source of light and a surface increases [concerning the light intensity].  
The light intensity decreases.
16. A light ray falls perpendicular to a reflecting surface.  
It will recoil on itself.
17. Incidence of light rays on a rough surface.  
The light rays are reflected in many directions.
18. Incidence of light rays on a smooth glistening surface.  
The light rays are reflected in one direction.
19. A light ray is incident on a plane mirror by an angle of incidence equals  $45^\circ$   
It will reflect by an angle of reflection equals  $45^\circ$ .
20. A light ray travels from a transparent medium to another one of different optical density.  
The light ray changes its path (It will refract).
21. A light ray falls perpendicular to the interface between two transparent media of different optical densities.  
It will pass without refraction.



PART  
2

22. A light ray travels from glass to air.  
It will refract far from the normal.
23. A light ray travels from air to glass.  
It will refract near the normal.
24. You look at a pencil partially immersed in water.  
It appears as being broken.
25. You look at a coin in a glass full of water.  
It will be seen in an apparent position higher than its real one.

## 8

## Comparisons :

## 1 Musical tones and noise :

| Musical tones                    | Noises                                  |
|----------------------------------|---|
| • Tones of uniform frequency.    | • Sounds of non-uniform frequency.      |
| • Comfortable to be heard.       | • Uncomfortable to be heard.            |
| <b>Example :</b> Sound of piano. | <b>Example :</b> Sound of loudspeakers. |

## 2 Sharp and rough sounds :

| Sharp sound                      | Rough sound                    |
|----------------------------------|--------------------------------|
| • High pitched sound.            | • Low pitched sound.           |
| • High frequency.                | • Low frequency.               |
| <b>Example :</b> Voice of women. | <b>Example :</b> Voice of men. |

## 3 Sound pitch and sound intensity :

| Sound pitch   | Sound intensity   |
|---|---|
| • It is a property by which the ear can distinguish between rough and sharp voices. | • It is a property by which the ear can distinguish between strong and weak voices.   |
| • It depends on the frequency of the sound source.                                  | • It depends on :<br>- The distance between the ear and the sound source.<br>- The amplitude of the sound source.<br>- The area of the vibrating surface.<br>- The density of the medium.<br>- The direction of the wind. |



## 4 Sonic, ultrasonic and infrasonic waves :

| Points of comparison  | Sonic waves                        | Ultrasonic waves              | Infrasonic waves |
|-----------------------|------------------------------------|-------------------------------|------------------|
| • Their frequencies : | Between 20 Hz to 20000 Hz (20 KHz) | Higher than 20000 Hz (20 KHz) | Lower than 20 Hz |
| • Hearing by man :    | Heard                              | Cannot be heard               | Cannot be heard  |

## 5 Transparent medium, translucent medium and opaque medium :

| Points of comparison | Transparent medium  | Translucent medium  | Opaque medium  |
|----------------------|---|---|--|
| • Definition :       | It is the medium which permits most light to pass through.  | It is the medium which permits only a part of light to pass through and absorbs the remaining part. | It is the medium that doesn't permit light to pass through.  |
| • Examples :         | <ul style="list-style-type: none"> <li>• Air</li> <li>• Pure water</li> <li>• Clear glass.</li> </ul> | <ul style="list-style-type: none"> <li>• Flint glass.</li> <li>• Tissue paper.</li> </ul>           | <ul style="list-style-type: none"> <li>• Molasses.</li> <li>• Human skin.</li> <li>• Plant leaves.</li> <li>• Milk.</li> </ul> |

## 6 Regular reflection and irregular reflection :

| Regular (uniform) reflection  | Irregular (non-uniform) reflection   |
|---|--|
| It is the reflection of light rays when they fall on a smooth (uniform) and glistening reflecting surface, where the incident light rays are reflected in one direction.                      | It is the reflection of light rays when they fall on a rough (non-uniform) reflecting surface, where the incident light rays are reflected in different directions.  |
| <b>Examples for smooth reflecting surface :</b> <ul style="list-style-type: none"> <li>• A plane mirror.</li> <li>• A thin sheet of aluminium.</li> <li>• A stainless steel sheet.</li> </ul> | <b>Examples for rough reflecting surface :</b> <ul style="list-style-type: none"> <li>• A leaf of a tree.</li> <li>• A piece of leather.</li> <li>• A piece of paper.</li> <li>• A piece of wool.</li> </ul> |

## 7 Light reflection and light refraction :

| Light reflection  | Light refraction  |
|---|---|
| <ul style="list-style-type: none"> <li>• It is the rebounding of light waves in the same medium on meeting a reflecting surface.</li> <li>• The angle of reflection equals the angle of incidence.</li> </ul> | <ul style="list-style-type: none"> <li>• It is the change of light path when it travels from a transparent medium to another one of different optical density.</li> <li>• The angle of refraction does not equal the angle of incidence.</li> </ul> |



## PART

## 2

## 9

## Activity :



## ACTIVITY 1

To illustrate the concept of sound pitch and its relation with sound frequency.



## Steps :

1. Tie a rubber string around a book and put two pencils below it.
2. Press on the string by the forefinger of the left hand at 10 cm. from one of the two pencils, then vibrate this segmented part of the string by the forefinger of the right hand.
3. Repeat the previous step by increasing the length of the vibrating segmented part of the string several times.



## Observation :

The sound becomes more harsher as the length of the string increases and becomes more sharper as the length of the string decreases.



## Explanation :

As the length of the string decreases, the number of vibrations produced in one second (frequency) increases.



## Conclusions :

- The sound pitch is a property of sound by which the ear can distinguish between harsh and sharp voices.
- The sound pitch depends on the frequency of the sound source.
- The sound pitch increases by increasing the frequency and vice versa.

(Sound pitch  $\propto$  Frequency)



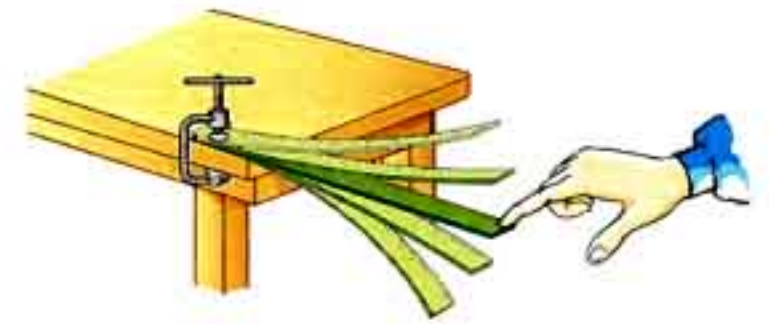
## ACTIVITY 2

To identify the effect of the amplitude of the sound source on sound intensity.



## Steps :

1. Fix one end of a ruler on the edge of a table by your right hand.
2. Pull the other end of the ruler downwards, then leave it free and notice the sound produced.



## Observation :

The intensity of sound decreases as time passes.



**Explanation :**

The amplitude of the ruler decreases gradually as time passes.

**Conclusion :**

Sound intensity decreases gradually by decreasing the amplitude of the vibration.  
(Sound intensity  $\propto$  Square of the amplitude)

**ACTIVITY 3**

To identify the effect of the area of the vibrating surface on the sound intensity.

| Steps  | Figures  | Observation  |
|--|--|--|
| <ol style="list-style-type: none"> <li>1. Hold your mobile which is adjusted to the vibrating mode in your hand, then ring on it from another mobile.</li> <li>2. Put the phone on an empty box which is opened at one of its sides to work as a resonance box.</li> <li>3. Compare between the intensity of sound that is produced in each case.</li> </ol> | <p>(Resonance box)<br/>Hollow empty box open from one side</p> | <p>The sound produced from the phone which is placed on the resonance box, is stronger than that is produced from the phone which is held.</p> |

**Explanation :**

The resonance box increases the vibrating surface area.

**Conclusion :**

Sound intensity increases when the sound source touches a resonance body (box).

**ACTIVITY 4**

To identify the effect of the medium density on the sound intensity.

| Steps  | Figure  | Observations   |
|--|---|--|
| <ol style="list-style-type: none"> <li>1. Ring an alarm clock, then put it on the air vacuum pump and cover it by the glass jar.</li> <li>2. Evacuate (pump out) the air inside the jar gradually (by drawing the arm of the vacuum pump outwards).</li> </ol> | <p>Arm of vacuum pump<br/>Glass jar<br/>Clock</p> | <ol style="list-style-type: none"> <li>1. The sound is heard clearly.</li> <li>2. The sound intensity decreases gradually until it stops as the air is pumped out of the jar.</li> </ol> |



PART  
2**Explanation :**

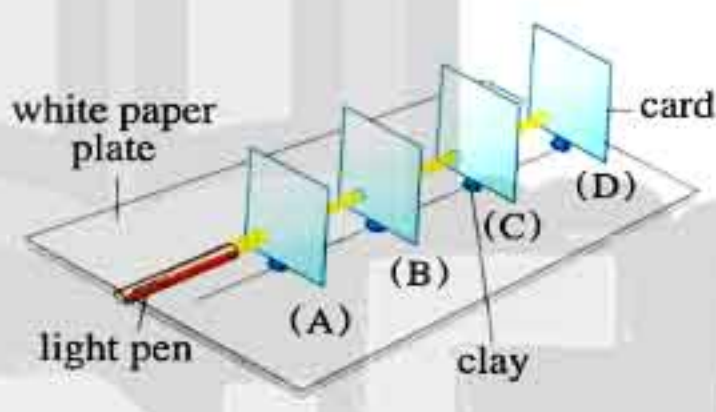
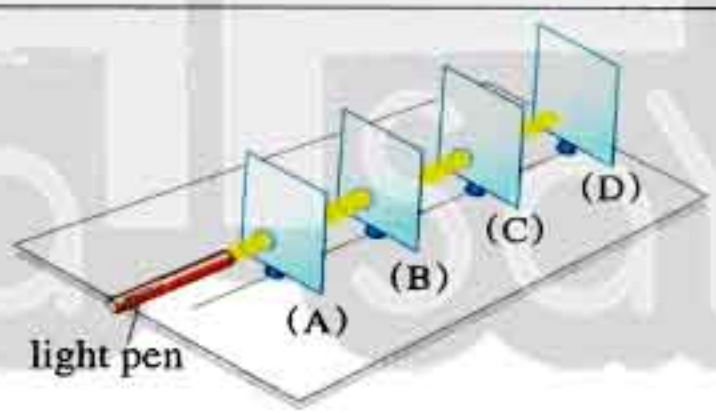
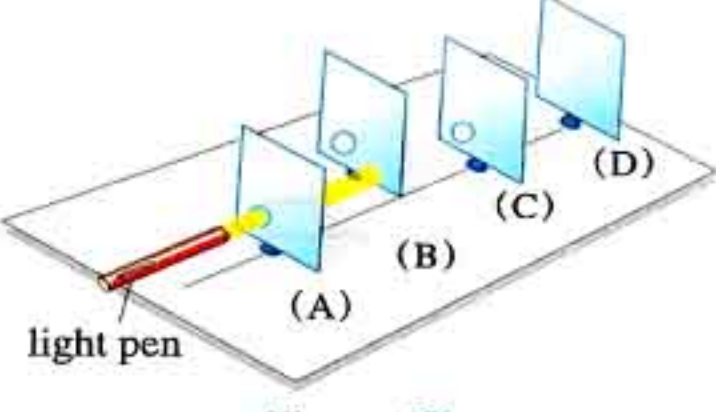
The air density decreases as you pull the air vacuum pump outwards.

**Conclusion :**

Sound intensity decreases by decreasing the density of the medium and vice versa.

**ACTIVITY 5**

To demonstrate (show) the propagation of light in straight lines :

| Steps   | Figures  | Observations  |
|---|--|---|
| 1. Make identical holes in the three cards [A , B , C] (as shown in figure 1).<br>2. Fix the four cards using clay on the white paper plate, where the holes lie on straight line.<br>3. Allow light of the light pen to pass through the hole of card (A). |  <p>Figure (1)</p> | The light ray passes through the holes in straight line and a light spot is formed on the card (D). |
| 4. Repeat the previous steps by replacing the cards with others have wider holes (as shown in figure 2).  |  <p>Figure (2)</p> | The area of the formed light spot increases by increasing the size of the holes.                    |
| 5. Move the card (B) to the left (as shown in figure 3).  |  <p>Figure (3)</p> | The light ray cannot pass through the card (B), so a light spot disappears on the card (D).         |

**Conclusion :**

Light travels through transparent media in the form of straight lines, whose size (thickness) can be controlled.





## ACTIVITY 6

- To illustrate the concept of light intensity.
- To show the light intensity of a surface changes by changing the distance between the surface and the light source.



### Steps :

1. Stand at 1 m away from a wall in a dark room and direct the light of a torch towards it.
2. Increase the distance between you and the wall to 2 metres, then 3 metres.



### Observation :

The light intensity of the light spot formed on the wall decreases as the distance between you and the wall increases.



### Explanation :

As the distance between the wall and the light source increases, the quantity of light incident on the unit area of the surface decreases.



### Conclusion :

- The quantity of light falling perpendicular to a unit area of a surface in one second is called "**Light intensity**".
- Light intensity of a surface decreases as the distance between the surface and the light source increases.



## ACTIVITY 7

To conclude the two laws of light reflection.

| Steps   | Figure | Observations   |
|---|--------|--|
| <ol style="list-style-type: none"> <li>1. Fix a plastic protractor perpendicular to the edge of a plane mirror.</li> <li>2. Direct a light ray on the protractor with an angle of incidence <math>30^\circ</math> from the point of incidence.</li> <li>3. Change the angle of incidence several times and measure the angle of reflection in each time.</li> <li>4. Change the inclination of the mirror, where the angle between them not be <math>90^\circ</math></li> </ol> |        | <ul style="list-style-type: none"> <li>- The angle of reflection changes according to the change of the angle of incidence, since they are equal.</li> <li>- The reflected ray not be seen.</li> </ul> |



### Conclusion :

The reflection of light is governed by two laws :

**First law** : Angle of incidence = Angle of reflection

**Second law** : The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all lie in one plane perpendicular to the reflecting surface.





## ACTIVITY

8

To demonstrate (show) the light refraction :

| Steps   | Figure |
|---|--------|
| <ol style="list-style-type: none"> <li>1. Put a rectangular glass block on a white paper sheet and mark around the block using a pencil.</li> <li>2. Direct a ray from the laser pen to the point of incidence (A) on the side of the rectangular glass and draw its path (using the pencil and the ruler) to represent the <b>incident ray</b>.</li> <li>3. Draw the path of the emergent ray from point (B) on the opposite side of the glass.</li> <li>4. Remove the rectangular glass and join the two points (A) and (B) with a straight line which represents the <b>refracted ray</b>.</li> <li>5. Draw at (A) and (B) dotted vertical lines, where it represents <b>the normal</b> at the point of incidence and at the point of emergence on the interface.</li> </ol> |        |



## Observations :

- When the light ray travels from air into glass or vice versa, it refracts.
- The angle of incidence ( $60^\circ$ ) is not equal to the angle of refraction ( $34.5^\circ$ ).
- The angle of incidence ( $60^\circ$ ) is equal to the angle of emergence ( $60^\circ$ ).
- The incident light ray is parallel to the emergent light ray.



## Conclusion :

The light refraction phenomenon occurs when the light ray travels from a transparent medium to another transparent medium of different optical density.



## Final Revision on Unit

3

1

## Definitions (or scientific terms) :

|   |   |
|---|---|
| 1. The flower :                                     | <ul style="list-style-type: none"> <li>• It is a short stem whose leaves are modified into reproductive organs.</li> <li>• It is the organ of sexual reproduction of flowering plants.</li> </ul> |
| 2. The bract :                                      | It is the green leaf, where the floral bud emerges from its axle and developed into a flower.   |
| 3. The inflorescence :                              | It is a group of flowers carried on the same axle.  |
| 4. Receptacle :                                     | It is the swollen part upon the flower pedicle on which the floral leaves are existed.  |
| 5. Calyx :  | It is the first (outermost) whorl of floral leaves which consists of a group of green sepals.   |
| 6. Corolla :  | It is the second whorl of floral leaves which consists of a group of coloured petals.   |
| 7. Androecium :                                     | It is the third whorl of floral leaves and it is the male ( $\sigma$ ) reproductive organ of the flower.  |
| 8. Gynoecium :                                      | It is the fourth (innermost) whorl of floral leaves and it is the female ( $\varphi$ ) reproductive organ of the flower.  |
| 9. Typical flower :                                 | It is the flower that contains four whorls.   |
| 10. Male flower ( $\sigma$ ) :                      | The flower that contains only male reproductive organ (androecium).   |
| 11. Female flower ( $\varphi$ ) :                   | The flower that contains only female reproductive organ (gynoecium).  |
| 12. Bisexual (Hermaphrodite) flower ( $\varphi$ ) : | The flower that contains both male and female reproductive organs.  |
| 13. Sexual reproduction in plants :                 | It is a kind of reproduction that occurs via flowers, it takes place in two successive processes which are pollination and fertilization.   |
| 14. Pollination :                                   | It is the process of transfer of pollen grains from the flower's anthers to the stigmas.  |
| 15. Self pollination :                              | It is the process of transfer of pollen grains from the anthers to the stigmas of the same flower or to another flower in the same plant.   |
| 16. Cross pollination :                             | It is the process of transfer of pollen grains from the anthers to the stigmas of another flower in other plant of the same kind.   |
| 17. Artificial pollination :                        | It is the pollination which is carried out by man.  |



|                                   |   |
|-----------------------------------|---|
| 18. Fertilization in plants :     | It is the process of fusion of the nucleus of male cell (pollen grain) with the nucleus of female cell (ovum) to form the zygote.   |
| 19. Micropyle :                   | It is the position of entrance of the male nucleus to the ovule inside the ovary.   |
| 20. Vegetative reproduction :     | It is a kind of asexual reproduction that takes place via parts of root, stem, leaves or buds.  |
| 21. Tuber :                       | It is a swollen part from a horizontal root or a terrestrial stem which contains growing buds and it is used for vegetative reproduction.   |
| 22. The cut :                     | It is a part of root, stem or leaf that is taken from the plant for vegetative reproduction.  |
| 23. The scion (graf) :            | It is a part of a plant which contains more than one bud and is placed on the stock during reproduction by grafting.  |
| 24. The stock :                   | It is a branch of the plant on which, the scion is placed during reproduction by grafting.  |
| 25. Reproduction by grafting :    | It is a kind of artificial vegetative reproduction in which a part of plant which contains more than one bud known as scion is selected to be placed on a branch of another plant known as the stock. |
| 26. Grafting by attachment :      | It is a kind of reproduction by grafting in which the scion is attached to the stock.   |
| 27. Grafting by wedge :           | It is a kind of reproduction by grafting in which the scion in the form of a wedge is inserted into a cleft in the stock.   |
| 28. Tissue culture :              | It is a process of multiplying a small part of a plant to get many identical plants.  |
| 29. Reproduction process :        | It is a process aims to secure the existence and continuity of living organisms species and to prevent them from extinction.  |
| 30. Ovulation process :           | It is the process of production of ova, where each ovary releases one ripe ovum every 28 days in exchange with the other ovary.   |
| 31. Age of menopause of females : | It is the age at which the menstrual cycle stops.   |
| 32. Fertilization in humans :     | It is the fusion of the nucleus of male gamete (sperm) with the nucleus of female gamete (ovum) to form the zygote (fertilized ovum).   |
| 33. Pregnancy period :            | It is the period between the fertilization process and delivery.  |
| 34. Genes :                       | They are structures present on the chromosomes and they are responsible for the hereditary traits.  |
| 35. Incubation period :           | It is the period between the beginning of the infection and the appearance of symptoms of the disease.  |



2

## Function or importance :

| The item                      | Function or importance  |
|-------------------------------|---|
| 1. Reproduction process :     | It aims to secure the existence and continuity of living organisms species and to prevent them from extinction.   |
| 2. Calyx :                    | Protection of the inner parts of the flower specially before blooming.  |
| 3. Corolla :                  | - Attraction of insects to the flower by its colour and odour to carry out the pollination process.<br>- Protection of reproductive organs of the flower. |
| 4. Androecium (Stamens) :     | Production and holding of pollen grains.  |
| 5. Gynoecium (Carpels) :      | Production of ovules.   |
| 6. Tissue culture :           | Producing large quantity of a plant by using a part of it.  |
| 7. Testes :                   | - Production of sperms.<br>- Production of male sex hormone (testosterone hormone).   |
| 8. Testosterone hormone :     | It is responsible for the appearance of secondary male sex characters.  |
| 9. Scrotal sac (scrotum) :    | Keeping the temperature of the testes 2°C below the normal body temperature.  |
| 10. Epididymis :              | - It stores sperms.<br>- The final stages of the growth and development of sperms take place in it.   |
| 11. Vas deferens :            | Transferring sperms from the testes to the urinary genital duct (urethra).  |
| 12. Genital glands in males : | Secretion of alkaline seminal fluid.  |
| 13. Seminal fluid :           | - Feeding the sperms.<br>- Facilitating the motion of sperms.<br>- Neutralization of the acidity of urine around the sperms in the urethra.               |
| 14. Penis :                   | Through which the semen and urine go out of the body but never at the same time.  |
| 15. Ovary (in human) :        | - Production of ova.<br>- Production of female sex hormones (estrogen and progesterone hormones).   |
| 16. Estrogen :                | It is responsible for the appearance of secondary female sex characters.  |
| 17. Progesterone :            | It is responsible for the occurrence and continuity of pregnancy.   |
| 18. Fallopian tubes :         | Receiving the ripe ovum and pushing it towards the uterus.  |
| 19. Uterus :                  | It protects and nourishes the fetus during the pregnancy until birth.   |
| 20. Placenta :                | It is responsible for nourishment of the fetus during pregnancy through the umbilical cord.   |
| 21. Vagina :                  | It expands during the labour to deliver (coming out) the baby.  |
| 22. Cytoplasm in the ovum :   | It stores food and nutrients.   |



PART  
2

|                                       |  |
|---------------------------------------|--|
| 23. Midpiece of the sperm :           | It contains mitochondria responsible for energy production needed for sperms movement. |
| 24. The tail of the sperm :           | It is responsible for the movement of the sperm till it reaches the ovum.              |
| 25. Enzymes secreted from the sperm : | They dissolve the cellular membrane of ovum during fertilization.                      |
| 26. Chromosomes :                     | They carry genes which are responsible for the hereditary traits of the organism.      |

## 3

## Give reasons for :

- The petals of corolla are colourful and scented.**  
To attract insects which transfer the pollen grains.
- The androecium is the male reproductive organ of the flower.**  
Because it produces and holds pollen grains.
- The gynoecium is the female reproductive organ of the flower.**  
Because it produces ovules.
- The flower of bean plant is a typical bisexual flower.**  
Because its flower contains four whorls.
- Palm flowers are unisexual.**  
Because the flowers contain only male or female reproductive organ.
- The pollination in barley plant is self pollination.**  
Because its flowers never bloom until completion of fertilization process.
- The pollination in flaxplant is self pollination.**  
Because the anthers and the stigmas are matured in the same time in the flower of this plant.
- The pollination of maize plant is mixed pollination.**  
Because the flowers of this plant are unisexual flowers.
- The pollination of sunflower plant is mixed pollination.**  
Because the anthers and the stigmas are not matured at the same time in the flower of this plant.
- Flowers pollinated by air having hanging anthers.**  
To be easily opened by air.
- The stigmas of air pollinated flowers are feathery like and sticky.**  
To catch pollen grains from air.
- Pollen grains of air pollinated flowers are produced in a huge number.**  
To compensate what are lost through air.



13. **Pollen grains of air pollinated flowers are light in weight and dry.**  
To be easily carried by air.
14. **Flowers pollinated by insects have coloured and scented petals.**  
To attract insects (like bees) to feed on its nectar.
15. **Flowers pollinated by insects produce coarse pollen grains.**  
To adhere on the insect's body.
16. **Sometimes, man has to pollinate palm trees.**  
To ensure the pollination process, as pollination is difficult to occur by insects or by air.
17. **Olive fruit contains only one seed, while bean fruit contains more than one seed.**  
Because the ovary of olive contains only one ovule, while that of bean contains many ovules.
18. **Some plants can be reproduced without flowers.**  
Because they reproduce asexually by parts of root, stem, leaves or buds.
19. **Potato can reproduce by tuber.**  
Because potato tuber contains many buds which grow to form the root system and the shoot system.
20. **In reproduction by cutting, a part of the cutting must be appeared above the soil.**  
Because the part above the soil surface will grow to form the shoot system of the plant.
21. **Reproduction by grafting can't be used between apples and peaches.**  
Because this kind of reproduction is used only between highly similar plant species.
22. • **Tissue culture is a good method for plant reproduction.**  
• **Tissue culture is considered from the important modern ways to increase crops.**  
Because, it is a process of multiplying a small part of a plant to get many identical plants.
23. **Man can't reproduce asexually.**  
Because the individuals coming from asexual reproduction are identical to their parents, while in human, each individual differs from others.
24. **The presence of testes outside the body in a sac-like structure called the scrotal sac.**  
Because it regulates and keeps the temperature of testes 2° below normal body temperature which is suitable temperature for the growth and development of sperms.
25. **Appearance of secondary male sex characters.**  
Due to the production of testosterone hormone by testes.
26. **The man, whose testicles are still present inside the abdominal cavity is infertile (sterile).**  
Because sperms will not grow or develop.
27. **The seminal fluid is alkaline.**  
To neutralize the acidity of urethra, so sperms will not die during their passage through urethra.



## PART

## 2

**28. The seminal fluid contains nutrients.**

To nourish the sperms.

**29. The right ovary produces one ripe ovum every 56 days.**

Because each ovary releases one ripe ovum every 28 days in exchange with the other ovary.

**30. Appearance of secondary female sex characters.**

Due to the production of estrogen hormone.

**31. Fallopian tubes are of funnel-shaped opening provided with finger-like projections.**

To receive the ripe ovum and direct it towards the uterus.

**32. The inner wall of fallopian tubes is lined with cilia.**

To direct the ovum towards the uterus.

**33. The uterus has a muscular wall.**

To expand as the fetus grows during the pregnancy period.

**34. The uterus is lined with mucus membrane rich in blood capillaries.**

To form the placenta which is responsible for the nourishment of fetus during the pregnancy.

**35. The uterus is a suitable organ for the growth of embryo.**

Because it has thick muscular wall that has blood capillaries which feed the embryo and supply it with oxygen and it also protects the embryo till birth.

**36. The midpiece of the sperm contains mitochondria.**

Because mitochondria responsible for energy production needed for the sperms movement.

**37. The sperm has a long and thin tail.**

Because it is responsible for movement of the sperm till it reaches the ovum.

**38. The ovum is relatively large in size.**

Due to the storage of nutrient materials.

**39. During fertilization, the head of sperm secretes enzymes on the ovum.**

To dissolve the cellular membrane of the ovum and facilitates its penetration inside the ovum.

**40. Fallopian tubes ligation is considered one of the means of birth control.**

Because the sperms don't reach the ripe ovum so, fertilization process doesn't happen.

**41. The ovum surrounds itself with a coat after the penetration of a sperm inside it.**

To prevent the penetration of any other sperm.

**42. The nucleus of a sperm or an ovum contains half the hereditary material.**

Because during fertilization, they fuse together to form zygote that contains a nucleus of 46 chromosomes (23 pairs of chromosomes).

**43. Zygote undergoes several successive divisions.**

To differentiate and continue to grow forming the embryo.



**44. The new born baby will carry the genetic traits of his parents.**

Because his cells contain 23 chromosomes coming from his mother (ovum) and 23 chromosomes coming from his father (sperm) during fertilization process.

**45. • A new laboured mother should avoid air currents after delivery.**

- It is necessary to wear masks during labour process.
- Preventing visits of persons who suffer from respiratory diseases to the mother after delivery.

To avoid the infection by puerperal sepsis disease.

**4**

### What happens ... ?

**1. When a pollen grain falls on the stigma of a flower.**

It will germinate forming a pollen tube.

**2. To the anther when pollen grains become mature.**

It will split longitudinally and pollen grains will spread in air like dust.

**3. When the anthers of air pollinated flowers are not hanged.**

Anthers will not be opened easily by air.

**4. When the stigmas of air pollinated flowers are not feathery like and not sticky.**

Stigmas will not catch pollen grains from air.

**5. When the petals of insect pollinated flowers are not coloured and with no scent.**

Insects will not be attracted to the flower.

**6. When the pollen grains of insect pollinated flowers are not sticky and with a smooth surface.**

Pollen grains will not adhere on the insect's body.

**7. If the stigma doesn't secrete sugary solution after its pollination.**

The pollen grain will not germinate.

**8. When the pollen tube doesn't reach the ovule.**

The male nuclei will not fuse with the ovum.

**9. To the ovary and the ovule after fertilization.**

The ovary will grow to become a fruit and the ovule will become a seed.

**10. To the zygote.**

The zygote undergoes successive divisions to form the embryo inside the ovary.

**11. When the tuber has no buds.**

It will not be able to reproduce.

**12. When a cut is cultivated completely inside the soil.**

The shoot system will not be formed.

**13. If the scion has no buds in reproduction by grafting.**

It will not be able to reproduce.



## PART

## 2

**14. If the scion and stock are not tightly tied together.**

The scion will not be able to feed on the juice of the stock.

**15. If the tissue is placed in a medium without hormones during tissue culture process.**

The tissue will not be able to grow.

**16. If the two testes present inside the body and don't come out during the embryo development.**

The sperms will not grow or develop and the individual becomes infertile.

**17. If the seminal fluid is not alkaline.**

The sperms will die during their passage through the urethra.

**18. If the testes are unable to secrete testosterone hormone.**

Disappearance of secondary sex characters in male.

**19. If the ovary is unable to secrete estrogen hormone.**

Disappearance of secondary sex characters in the female.

**20. If the ovary is unable to secrete progesterone hormone.**

No pregnancy will occur.

**21. If the fallopian tube is not ciliated and has no muscular wall.**

It will not be able to direct the ovum towards the uterus.

**22. If the fallopian tubes are ligated.**

The sperms do not reach the ripe ovum.

**23. If the mucus membrane lining the uterus has no blood capillaries.**

Placenta will not be formed.

**24. When the middle part of a sperm is damaged.**

No energy will be produced and the sperm will not be able to move or attack the ovum.

**25. If the sperm has no tail.**

It will not move.

**26. If the sperm head is unable to secrete enzymes on the ovum.**

It will not be able to penetrate the ovum.

**27. If the sperms are not mobile cells.**

They will not reach the ovum.

**28. When the sperms are completely formed in the testes and go out from it.**

They will go to the epididymis then to the vas deferens then enter the urethra, finally exit from the urinary genital opening.

**29. If the ripe ovum is not fertilized.**

It will go to the fallopian tubes then to uterus, finally exit from the urinary genital opening with the menstrual blood.



30. • When the wound of recently laboured mother is infected by spherical bacteria.  
• The recently laboured mother is subjected to air currents.  
She will be infected by puerperal sepsis disease.

31. If the syphilis infected person is not treated.

Tumors will appear in different body parts like the liver, bones and parts of genital system, the brain may also be damaged and the patient will die.

5

## Comparisons :

- 1 The four whorls of a typical flower :

| Whorl            | Calyx  | Corolla  | Androecium                    | Gynoecium  |
|------------------|--|--|-------------------------------|--|
| 1. Position :    | The first (outermost) whorl                        | The second whorl   | The third whorl               | The fourth (innermost) whorl                               |
| 2. Consists of : | Sepals   | Petals   | Stamens                       | Carpels  |
| 3. Description : | Green leaves, surrounding the flower from outside. | Bright coloured scented leaves.                                  | Fine filament, ends in a sac. | It look like a flask, locates in the centre of the flower. |
| 4. Function :    | Protection of the inner parts of the flower.       | - Attraction of insects.<br>- Protection of reproductive organs. | Production of pollen grains.  | Production of ovules.                                      |

- 2 Androecium and gynoecium :

| Points of comparison         | Androecium                                | Gynoecium  |
|------------------------------|---|--|
| 1. Position :                | - It is the third whorl of floral leaves. | - It is the fourth (innermost) whorl of floral leaves. |
| 2. Its sex :                 | - Male reproductive organ.                | - Female reproductive organ.                           |
| 3. Its leaves are known as : | - Stamens.                                | - Carpels.   |
| 4. Function :                | - It produces and holds pollen grains.    | - It produces ovules.                                  |

- 3 Male flower, female flower and hermaphrodite flower :

| Points of comparison | Male flower                               | Female flower                              | Hermaphrodite flower                      |
|----------------------|---|--|---|
| 1. It contains :     | Only male reproductive organ (androecium) | Only female reproductive organ (gynoecium) | Both male and female reproductive organs. |
| 2. Its kind :        | Unisexual                                 | Unisexual                                  | Bisexual                                  |
| 3. Its symbol :      | ♂   | ♀  | ♀   |
| 4. Examples :        | Palm and maize                            | Palm and maize                             | Tulip and petunia                         |
| 5. No. of whorls :   | 3 whorls                                  | 3 whorls                                   | 4 whorls                                  |



## 4 Self pollination and cross pollination :

| Self pollination   | Cross pollination  |
|--|--|
| It is the transfer of pollen grains from the anthers to the stigmas of the same flower or to another flower in the same plant. | It is the transfer of pollen grains from the anthers to the stigmas of another flower in other plant of the same kind. |
| Ex. : • Barley plant.                      • Flax plant.   | Ex. : • Sunflower.                      • Maize.   |

## 5 Pollination and fertilization :

| Pollination  | Fertilization   |
|--|---|
| It is the process of transfer of pollen grains from the flower's anthers to the stigmas. | It is the process of fusion of the nucleus of male cell with the nucleus of female cell to form the zygote. |

## 6 Air-pollinated flowers and insect-pollinated flowers :

| Air-pollinated flowers  | Insect-pollinated flowers  |
|---|--|
| <ul style="list-style-type: none"> <li>• The anthers are hanged.</li> <li>• The stigmas are feathery like and sticky.</li> <li>• The pollen grains are light in weight and dry and produced in huge numbers.</li> </ul> | <ul style="list-style-type: none"> <li>• The petals are coloured and scented.</li> <li>• The pollen grains are sticky or having coarse surface.</li> </ul> |

## 7 Vegetative reproduction and flowering reproduction :

| Vegetative reproduction  | Flowering reproduction  |
|--|---|
| <ul style="list-style-type: none"> <li>• Asexual reproduction.</li> <li>• It takes place via parts of root, stem, leaves or buds.</li> </ul> | <ul style="list-style-type: none"> <li>• Sexual reproduction.</li> <li>• It takes place via flowers.</li> </ul> |

## 8 Natural vegetative reproduction and artificial vegetative reproduction.

| Natural vegetative reproduction  | Artificial vegetative reproduction  |
|--|---|
| It takes place by many ways such as, reproduction by : Rhizomes, corms, tubers, bulbs and offshoots. | It takes place by four ways which are cutting, grafting, tissue culture and layering. |

## 9 Grafting by attachment and grafting by wedge :

| Grafting by attachment   | Grafting by wedge  |
|--|--|
| <ul style="list-style-type: none"> <li>- In which the scion is attached to the stock.</li> <li>- Ex. : Mango trees.</li> </ul> | <ul style="list-style-type: none"> <li>- In which the scion in the form of a wedge is inserted into a cleft in the stock.</li> <li>- Ex. : Large trees.</li> </ul> |



## 10 Testes and ovaries :

| Points of comparison | Testes  | Ovaries  |
|----------------------|---|--|
| 1. Description :     | - Two glands of oval shape.   | - Two glands having the size of a peeled almond.   |
| 2. Position :        | - In male, in scrotal sac which is hanged between man's thighs.               | - In female, in the lower part of the abdominal cavity from the back.                      |
| 3. Function :        | 1. Production of sperms.<br>2. Production of male sex hormone (testosterone). | 1. Production of ova.<br>2. Production of female sex hormones (estrogen and progesterone). |

## 11 Signs of puberty in male and female :

| In male   | In female   |
|---|---|
| 1. Growth of hair in certain body areas (like face and mustache).<br>2. Harshness of voice.<br>3. Development of genital organs.<br>4. Growth of bones.<br>5. Enlargement of muscles. | 1. Growth of hair in armpit and pubic.<br>2. Softness of voice.<br>3. Growth and development of breasts.<br>4. Accumulation of fats in some body regions.<br>5. Occurrence of menstrual cycle every 28 days, as long as no pregnancy happens. |

## 12 Testosterone, estrogen and progesterone hormones :

| Points of comparison | Testosterone hormone  | Estrogen hormone  | Progesterone hormone                               |
|----------------------|---|---|--|
| 1. Kind :            | Male hormone  | Female hormone  |  |
| 2. Secreted by :     | Testes  | Ovaries   |  |
| 3. Function :        | It is responsible for the appearance of secondary sex characters in male. | It is responsible for the appearance of secondary sex characters in female. | It is responsible for the continuity of pregnancy. |

## 13 The sperm and the ovum :

| Points of comparison | The sperm  | The ovum  |
|----------------------|--|---|
| 1. Size :            | - Small.   | - Relatively large.   |
| 2. Mobility :        | - Mobile.  | - Static (not mobile).  |
| 3. Structure :       | - It consists of :<br>The head, midpiece and tail. | - It consists of :<br>The nucleus, cytoplasm and cellular membrane. |



## 14 Puerperal sepsis and syphilis diseases :

| Points of comparison                 | Puerperal sepsis  | Syphilis   |
|--------------------------------------|---|--|
| 1. The microbe causing the disease : | Spherical-shaped bacteria.  | Spiral-shaped bacteria.  |
| 2. Methods of infection :            | 1. By droplets from a person infected with bacteria and suffering from throat infection or tonsillitis to the vagina of a recently laboured mother.<br>2. An infected wound during the labour.  | 1. Sexual contact with an infected or a carrier person.<br>2. From pregnant woman to her fetus through the amblical cord or during the delivery.   |
| 3. Incubation period :               | from 1 to 4 days.   | from 2 to 3 weeks.   |
| 4. Symptoms :                        | 1. High elevation in body temperature.<br>2. Chills. 3. Face paling.<br>4. Severe acute pain in lower abdomen.<br>5. Bad smelling secretions from the uterus.   | 1. Appearance of painless hard ulcer on the head of penis (in male) and in the vagina and the upper part of cervix (in female).<br>2. Appearance of dark brass coloured rashes on the back and hands of the patient. |
| 5. Methods of protection :           | 1. Sterilizing the surgical tools.<br>2. Wearing masks during labour (delivery).<br>3. Preventing visits of persons who suffer from respiratory diseases to the mother after delivery.<br>4. The mother should be kept warm and avoid the exposure to air currents. | 1. Preventing the sexual contact with infected person (preventing the illegal contacts).<br>2. The abortion of the infected pregnant women.  |

## 6

## Activities :



## ACTIVITY

## 1

To study pollen grain germination.



## Steps :

1. Place a drop of diluted sugary solution on a glass slide and put some pollen grains, then cover them with a glass cover.
2. Repeat the previous step with replacing diluted sugary solution by water.
3. Keep both slides in a dark and warm place for half an hour.
4. Examine the two slides under the microscope.



**Observations & Conclusions :**

- The pollen grain of sugary solution germinates by formation of a pollen tube containing two male nuclei and one tube nucleus.
- That is similar to what happens to a pollen grain falls on a flower stigma.

**ACTIVITY 2**

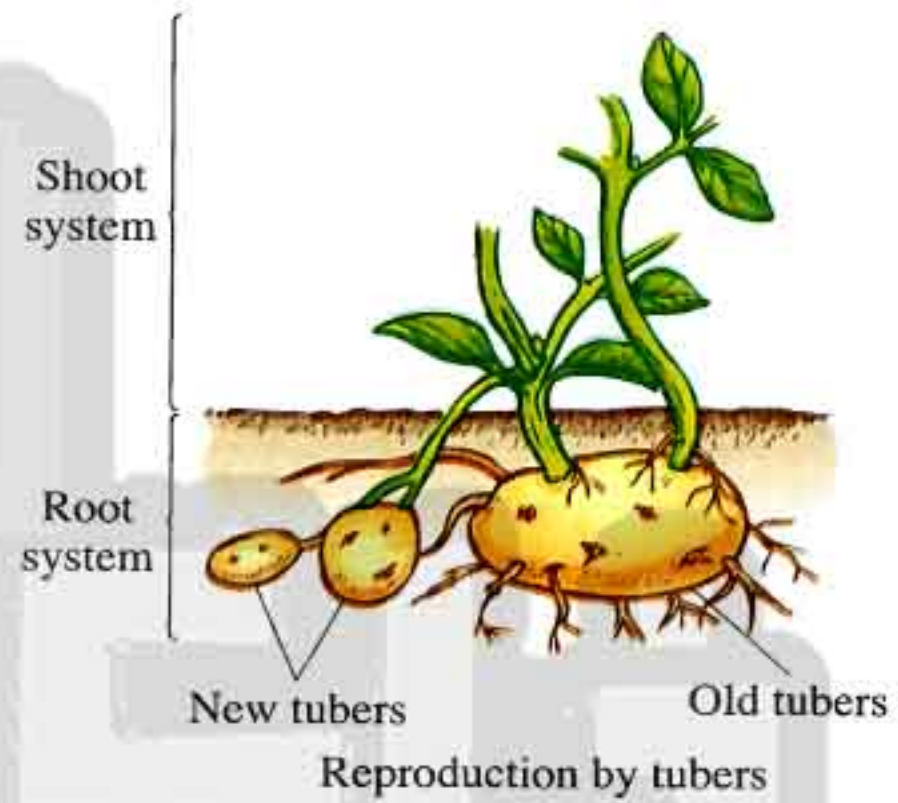
To identify the reproduction by tubers.

**Steps :**

1. Cut a tuber of potato into multiple slices, where each slice should contain a bud or more.
2. Cultivate these parts and water (irregate) them regularly for a week.

**Observations & Conclusions :**

- Some buds grow forming a root system.
- Other buds grow forming a shoot system.
- After days new tubers grow.

**ACTIVITY 3**

To identify the reproduction by tubers.

**Steps :**

1. Get some cuts of different plants (grapes, roses, sugar cane, ....).
2. Cultivate one of them in a pot (or a can) full of soil such that a bud or more should appear above the soil surface.
3. Water the cut regularly for two weeks.

**Observations & Conclusions :**

- The buds **buried inside the soil** grow to form the **root system** of the plant.
- The buds **above the soil surface** grow to form the **shoot system** of the plant.



PART

2

7

## Important drawings :

## 1 The structure of a typical flower.



## 2 Male flower ♂ (Unisexual).



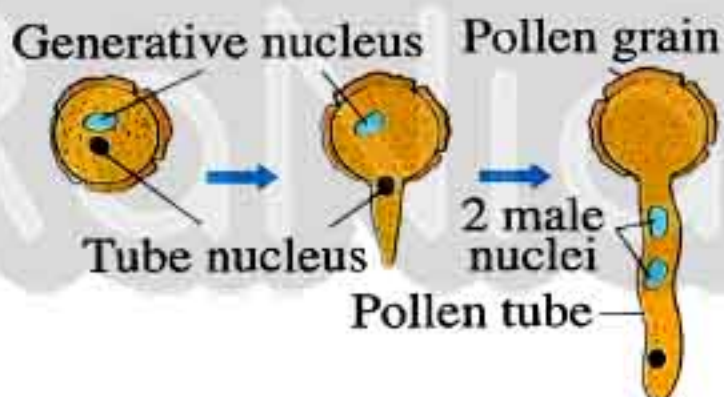
## 3 Female flower ♀ (Unisexual).



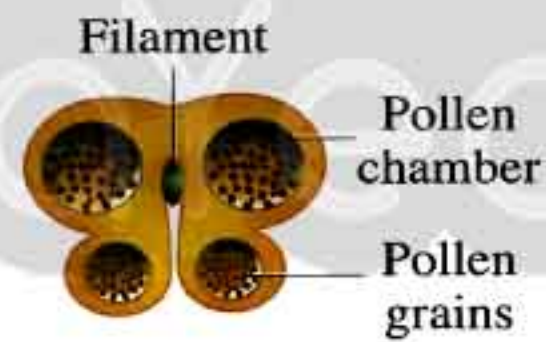
## 4 Hermaphrodite flower ♀ (Bisexual).



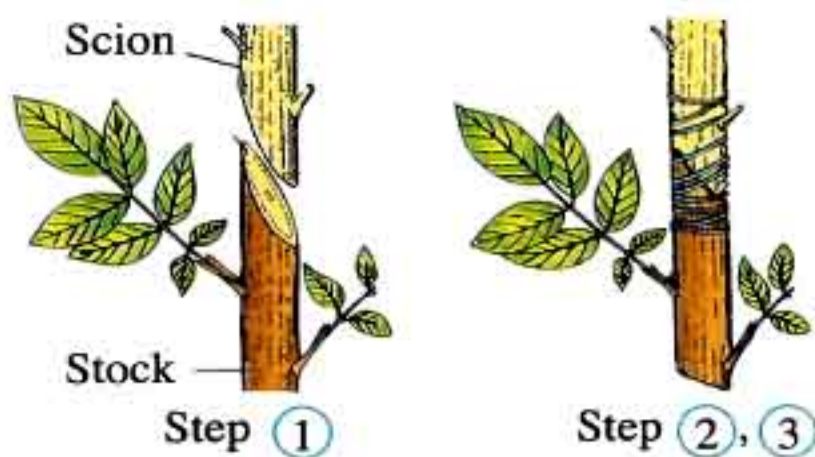
## 5 Germination of pollen grain.



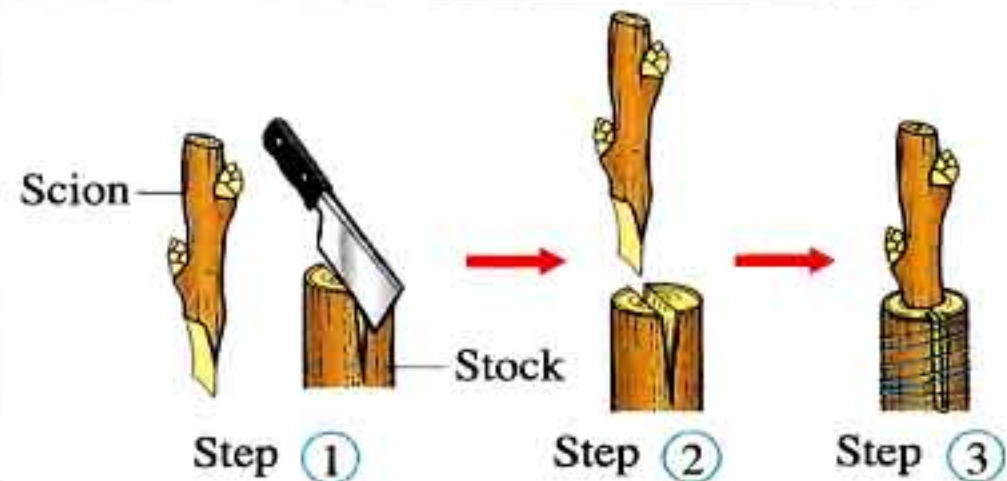
## 6 A cross-section in an anther.



## 7 • Grafting by attachment.

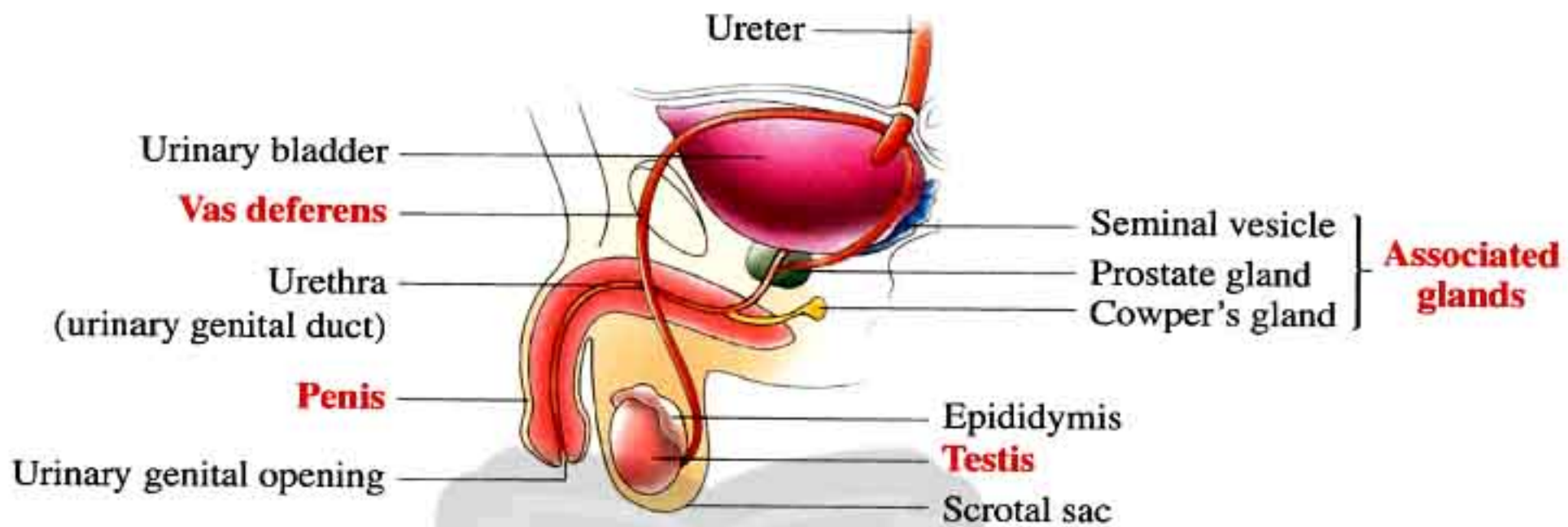


## • Grafting by wedge.

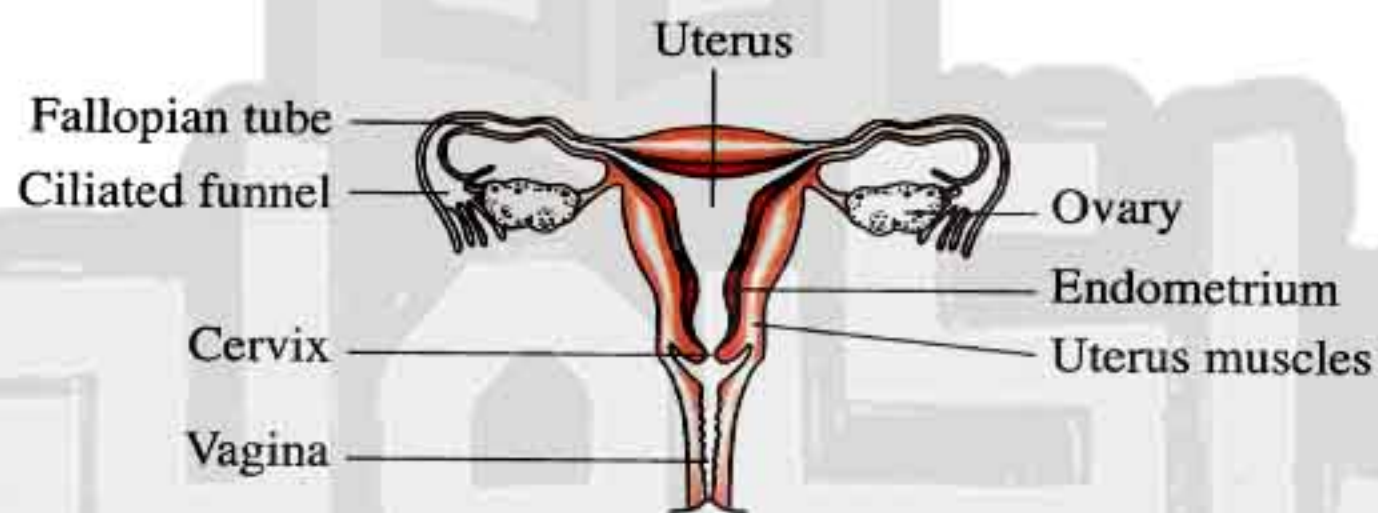




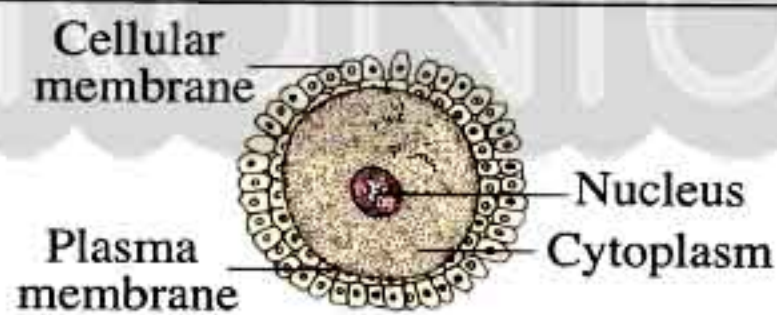
## 8 Male reproductive system.



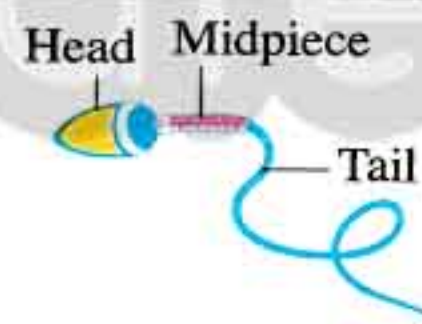
## 9 Female reproductive system.



## 10 The structure of the ovum.



## 11 The structure of the sperm.





PART

3

## Final Examinations

**Important note :**

There is an additional question at the end of the school's examinations on the parts which are canceled from the syllabus of the previous year.



1

Cairo Governorate

Modern college School

Answer the following questions :

Question

1

**A Complete the following statements :**

1. The crest in ..... wave is equivalent to ..... in longitudinal wave.
2. The frequency of sonic waves ranges between ..... and .....
3. The measuring unit of wave velocity is .....
4. The floral leaves of calyx have green color called .....
5. When we look at coin in a glass of water, it's ..... position appears to be lower than the ..... position.
6. The sound intensity is inversely proportion with ..... while sound pitch is directly proportion with .....

**B Give one different between :**

1. Mechanical waves and electromagnetic waves.
2. The stamen and carpel.

Question

2

**A Write the scientific term for each of the following :**

1. Distance covered by wave in one second.
2. The ability of transparent medium to refract the light.
3. Changing the path of light when travel from a transparent medium to another of different in optical density.
4. The angle of incidence = the angle of reflection.
5. Short stem where leaves developed and modified into reproductive organs.
6. Sound wave used for sterilization of food.

**B Give reasons for :**

1. The oscillatory motion is considered as a periodic motion.
2. The absolute refractive index of any transparent medium is always greater than one.
3. The flower of tulip and petunia are typical bisexual flower.

**C Savart's wheel rotates with a rate of 360 per minute. If the number of teeth of gear is 50 teeth calculate the frequency of sound ?**



## PART

## 3

## Question

3

## A Correct the underlined word :

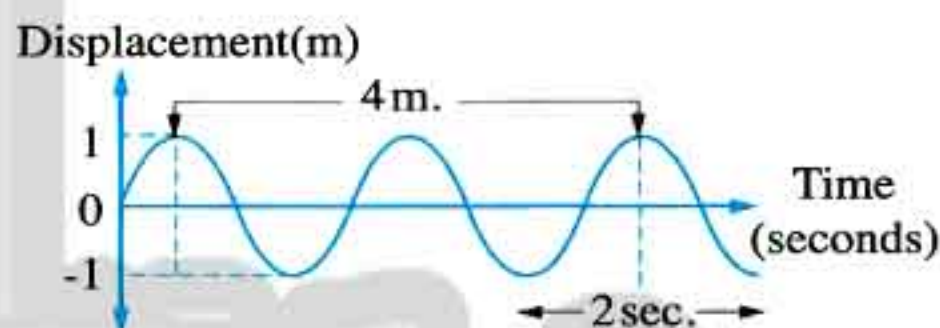
1. **Periodic time** is number of completed oscillation in one second.
2. The distance between two successive crest or trough is wave length of **longitudinal wave**.
3. The pollen grains of insect pollinated flower are **smooth**.
4. Sound travelling in air has **more** intensity than that in carbon dioxide.
5. The **head** of sperm contains mitochondria.
6. **Bract** is a group of flowers arranged on same axle.

## B What is meant by ... ?

1. Amplitude.
2. Fertilization.
3. Wave motion.

## C From the opposite figure, find :

1. Wavelength.
2. Frequency.
3. Amplitude.
4. Wave velocity.



## Question

4

## A Choose the correct answer :

1. The sound of frequency 600 Hz is ..... the sounds of frequency 200 Hz.  
a. stronger      b. sharper      c. weaker      d. harsher
2. The complete oscillation includes ..... successive displacement.  
a. one      b. two      c. three      d. four
3. The measuring unit of noise intensity is .....  
a. decibel.      b. watt/m<sup>2</sup>.      c. Hertz.      d. meter/sec.
4. The angle between the incident light ray and the reflected light ray is 60°, so the angle of reflection .....  
a. 20°      b. 30°      c. 80°      d. 90°
5. All the following are part of female reproductive system except .....  
a. vas deferens.      b. uterus.      c. ovary.      d. fallopian tube.
6. In ..... reflection, the reflected rays are reflected in many direction.  
a. uniform      b. irregular      c. regular      d. total internal

## B Mention the function or (uses) of each of the following :

1. Estrogen hormone.
2. Physiotherapy tub (Jacuzzi).

## C What happen when ... ?

1. A light ray falls perpendicular to reflecting surface.
2. You put a vibrating tuning fork on a resonance box.



## Additional questions

## A Complete the following statements :

1. The glass prism is used to analyse the ..... light into ..... colours.
2. .... and ..... are examples of genital diseases which don't arise from sexual contact.

## B Give reasons for :

The energy of red light photon is less than that of orange light photon.

2

Cairo Governorate

Manaret El-Eman Language School

Answer the following questions :

Question

1

## A Put (✓) or (x) :

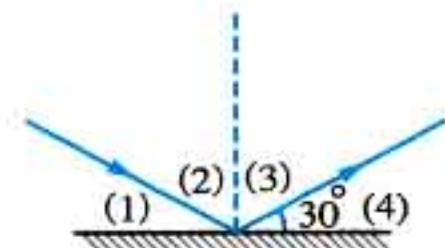
1. The progesterone hormone is responsible for appearance of secondary sexual characteristics in male. ( )
2. The sound quality is the property by which the ear can distinguish between strong and weak sound. ( )
3. palm trees are pollinated by the help of man. ( )
4. The sound intensity decrease when the source of sound touches an empty box. ( )
5. In longitudinal waves the point of highest density and pressure is called rarefaction. ( )
6. The ability of the transparent medium to refract light is called the optical density of the medium. ( )

## B Give reasons for each of the following :

1. Flowers pollinated by insects produce coarse pollen grains.
2. The use of ultrasonic waves in milk sterilization.
3. Radio waves are transverse waves but sound waves are longitudinal waves.
4. The piano sound differs from that of a violin even they have the same pitch and intensity.
5. Petals of corolla are colorful and scented.
6. The presence of the testes in human male outside the body in the scrotal sac.

## C Look at the opposite figure, then answer :

The angle of incidence is the angle number .....  
and it equals .....





## PART

## 3

## Question

2

## A Choose the correct answer :

- The male reproductive organ in the flower is .....  
a. gynoecium.      b. androecium.      c. corolla.      d. prostate.
- A pencil partially immersed in water appears as being broken due to the ..... of light rays.  
a. refraction      b. reflection analysis  
c. reflection      d. no correct answer
- All of the following factors affecting sound intensity except .....  
a. amplitude.      b. frequency.      c. wind direction.      d. medium density.
- The angle of incidence is ..... the angle of reflection.  
a. larger than      b. less than      c. equal to      d. no correct answer
- All the following are examples of the oscillatory motion except .....  
a. swing.      b. spring.      c. rotary bee.      d. tuning fork.
- The human ear can hear sound of frequency .....  
a. 50 KHz.      b. 30 KHz.      c. 300 Hz.      d. 10 Hz.

## B What happens to each of the following ... ?

- Ovary after fertilization.
- A light ray falls perpendicular on a reflecting surface.
- The oscillating body passes its rest position during its movement. (concerning velocity)
- The wavelength increases to double value when the wave velocity is constant. (concerning the frequency)

## C Mention one function for each of the following :

- Ultrasonic waves.
- Gynoecium.
- The testes.
- Savart's wheel.

## Question

3

## A Write the scientific term for each of the following :

- The highest point of the particles of the medium in the transverse waves.
- The fusion of the male gamete with the female gamete.
- The angle between the incident light ray and the normal at the point of incidence on the interface.
- The reciprocal of the frequency.
- Short stem where the leaves are developed and modified into reproductive organs.
- A phenomenon that appears in the desert as a result of refraction and reflection of light.
- The process of multiplying a small part of a plant to get many identical plants.
- Two glands, each of them is in a size of a peeled almond and they lie inside the female body in the lower part of the abdominal cavity.



**B Compare between each of the following :**

1. The sperm and the ovum (regarding to the size and the motion).
2. Mechanical and electromagnetic waves. (definition and examples)

**C If the frequency of a sound wave is 200 Hz and the wavelength of this wave is 1.5 meter : Calculate the velocity of sound waves propagation in air.****Question 4****A Complete the following statements :**

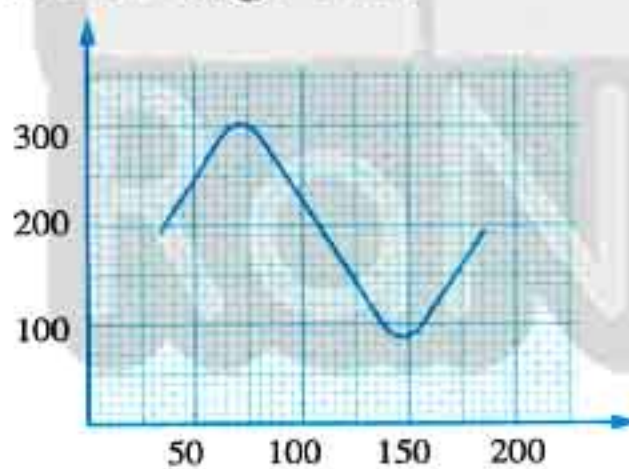
1. From the artificial vegetative reproduction in plant are ..... and .....
2. Reflection of light is classified into two types which are ..... reflection and ..... reflection.
3. Calyx of a flower consists of green leaves called .....
4. The measuring unit of noise intensity is .....
5. Each ovary produces one ovum every ..... days in exchange with the other ovary.
6. Sound is produced due to ..... of bodies.

**B What is meant by ... ?**

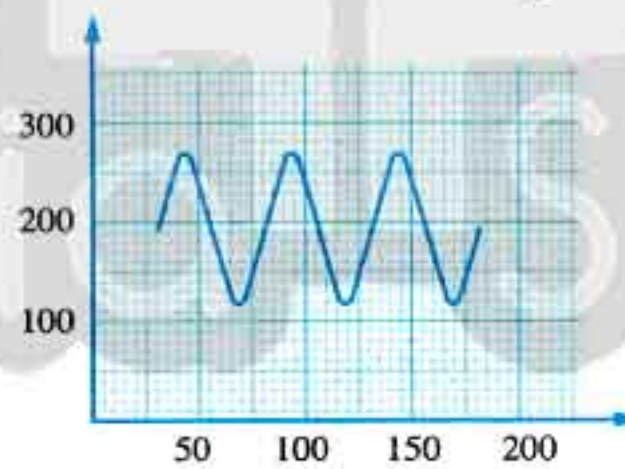
1. Sound pitch.
2. Pollination.
3. Amplitude.
4. The absolute refractive index.

**C From the following figure, find :**

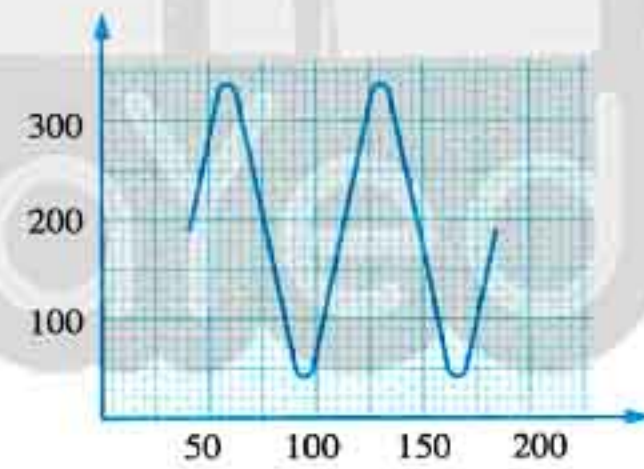
1. The rough tone.
2. The sharper tone.



(a)



(b)



(c)

**Additional questions****A Choose the correct answer :**

1. The incubation period of puerperal sepsis disease ranges from .....  
 a. 1 to 4 days.      b. 2 to 6 days.      c. 1 to 4 weeks      d. 2 to 3 weeks.
2. White light consists of ..... spectrum colours.  
 a. nine      b. six      c. seven      d. eight.

**B Give reasons for :**

A recently laboured mother should avoid air currents after delivery.



Answer the following questions :

**Question**

**1**

**A Complete the following statements :**

1. The ..... hormone in male and ..... hormone in female are responsible for the appearance of secondary sex characters.
2. The light reflection is classified into two types which are ..... and .....
3. The mechanical waves are classified into ..... and .....

**B Define :**

1. Sound quality.
2. Pollination.

**C Mention the mathematical relations between :**

1. Frequency and periodic time.
2. Wave velocity and wavelength.

**Question**

**2**

**A Compare between : (one point)**

1. Sonic waves and infrasonic waves.
2. Vegetative reproduction and flowering reproduction.
3. Sound pitch and sound intensity.

**B Mention the measuring unit of :**

1. Amplitude.
2. Sound velocity.
3. Noise intensity.
4. Periodic time.

**C Calculate the angle of reflection if the angle between the incident light ray and the reflected light ray is  $60^\circ$**

**Question**

**3**

**A What is meant by ... ?**

1. The wavelength of a longitudinal wave is 30 cm.
2. The number of complete oscillations of a body in 10 sec. is 500 oscillations.
3. The amplitude of an oscillating body is 6 meter.

**B Mention the importance of :**

1. Ultrasonic waves.
2. Corolla in flower.

**C Calculate the number of gear's teeth of savart's wheel, given that the frequency of the sound produced is 300 Hz and wheel rotates with a rate 30 cycles per second.**



## Question 4

## A Give reason for :

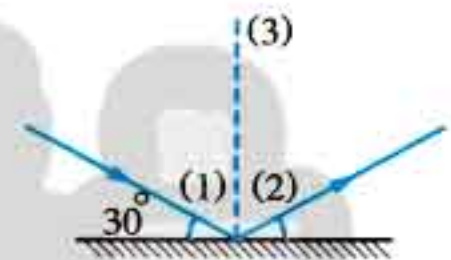
1. The absolute refractive index of a medium is greater than one.
2. The flower of bean plant is bisexual.
3. Light can travel through space.

## B Put (✓) or (x) :

1. The light ray refracts towards the normal when it travels from air to glass. ( )
2. The particles of the medium vibrate along the direction of the wave propagation in longitudinal wave. ( )
3. The sound intensity decreases when it touches a resonance box. ( )
4. The swing is an example of periodic motion. ( )

## C Look at the opposite figure, then answer :

1. Write the Labeled (1), (2) and (3).
2. Calculate the measurement of angle (2).



## Additional questions

## A What is meant by ..... ?

Visible light.

## B What happens when ..... ?

1. Incidence of a white light ray on one face of triangular glass prism.
2. The syphilis infected person is not treated.

4

Cairo Governorate

B. Karnak Language School

Answer the following questions :

## Question

1

## A Complete the following :

1. Sound is from ..... waves that can't travel through .....
2. In a flower, the calyx consists of ....., but group of petals form .....
3. The high pitched sound waves have high ..... and small .....



## PART

## 3

4. The ear can't hear sounds with frequencies less than ..... Hz, but can hear sounds of frequencies up to ..... Hz.
5. Waves are classified according to their ability to propagate and transfer energy into ..... and .....
6. There are two types of periodic motion which are ..... motion and ..... motion.
7. Light ..... is the change of light path when it travels from a transparent medium to another one of different .....

**B Calculate the speed of light in diamond given that the absolute refractive index of it = 2.4 and speed of light in air =  $3 \times 10^8$  m/s.**

**C Compare between :**

1. Regular reflection - irregular reflection. (direction of reflected rays)
2. Two testes – two ovaries. (their function)
3. Longitudinal waves – transverse waves. (direction of vibrating particles)
4. Zygote – pollen grains. (the number of genetic materials)

## Question

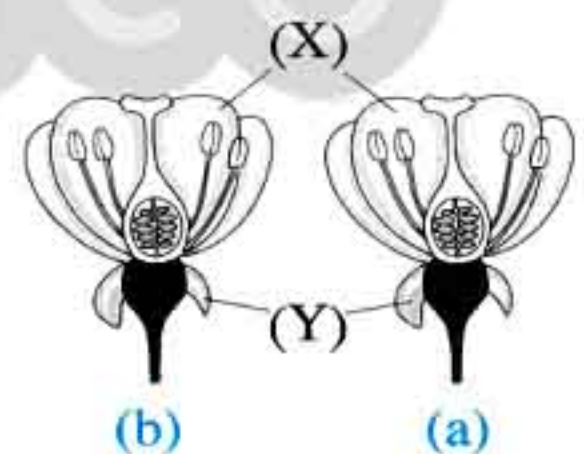
## 2

**A Correct the underlined words :**

1. Complete oscillation consists of  $\frac{1}{4}$  amplitude.
2. The motion of rotatory bee is considered as an oscillatory motion.
3. The infrasonic waves are used in breaking down kidney stones.
4. Sound pitch is increased by decreasing density of medium.
5. Speed of sound in water is slower than in air.

**B Look at the opposite figure, then answer the following :**

1. What is the function of the parts (X) and (Y) ?
2. Pollen grains from the flower (a) are transferred to the ova in flower (b) :
  - What is the type of pollination that happened ?
  - Write two methods for this kind of pollination ?
  - What is the sex of the flower (b) ?
  - Write the name of two plants having the same sex of flower.



**C Calculate the wavelength for each of the following :**

1. A transverse wave, the distance between its second and seventh crest = 21 meters.
2. A longitudinal wave, the distance between the centres of its successive compression and rarefaction = 14 meters.



## Question 3

## A Write the scientific term :

1. A property by which the ear can distinguish between harsh and sharp voices.
2. A tube in female reproductive organ, which receive ovum and connect it to the uterus.
3. The angle between the reflected ray and the normal at the incident point on the reflecting surface.
4. A disturbance causes the vibration of medium particles.
5. The measuring unit of the sound intensity.

## B Give reason for :

1. We can distinguish between different sounds even they have the same pitch and intensity.
2. We see lightening before hearing thunder.
3. Sound of man is harsh, while sound of woman is sharp.

## C What happens when ... ?

1. Increasing the wavelength four times for the same velocity. (concerning wave frequency)
2. Falling of pollen grain on a stigma of the same flower. (type of pollination and flower)

## D Calculate : The frequency of a musical tone similar to the tone produced from savart's wheel rotating with a velocity of 960 cycle in two minutes, knowing that the number of gear teeth = 30

## Question 4

## A Choose the correct answer :

1. The ratio between the periodic time of a tuning fork vibrate with 100 Hz, and the periodic time of another tuning fork vibrate with 200 Hz equals .....  
a. 1 : 1                      b. 2 : 1                      c. 1 : 2                      d. zero
2. The zygote contains ..... of the genetic material of the female somatic cell.  
a. half                      b. double                      c. quarter                      d. three times
3. The light ray refract ..... the normal when it travels from air to glass.  
a. near to                      b. away from                      c. perpendicular to                      d. along
4. All the following are from the factors affecting sound intensity except : .....  
a. amplitude.                      b. frequency.  
c. density of medium.                      d. wind direction.
5. Sound waves have frequency 400 Hz and its wavelength is 85 cm so, its velocity = .....  
a. 340 m/s                      b. 34000 m/s                      c. 3.4 m/s                      d. 0.034 m/s
6. A pencil seems broken when it is placed in a glass cup of water due to ..... of light.  
a. critical angle                      b. mirage                      c. refraction                      d. reflection



## PART

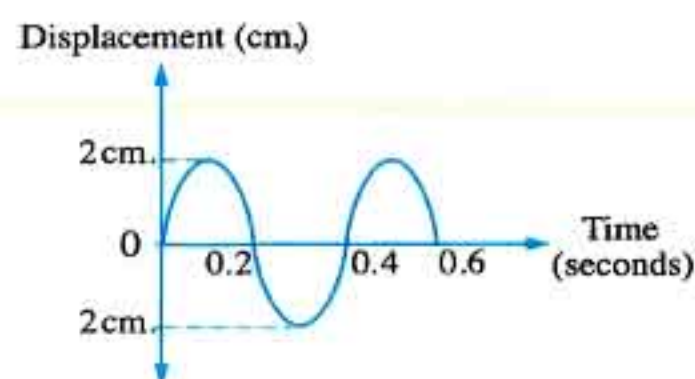
## 3

**B Put (✓) or (✗) and correct the wrong one :**

1. The fish is seen higher than its real position in the fish tank. ( )
2. The amplitude is the covered distance in a complete oscillation. ( )
3. The velocity of the oscillating body is maximum when passing through original position. ( )
4. Androecium is the female reproductive organ in plant. ( )

**C From the figure below calculate :**

1. Amplitude.
2. Periodic time.
3. Frequency.
4. What is the type of this wave ?

**Additional questions****A Complete the following statements :**

1. The light velocity is the distance .....
2. The infection with syphilis and ..... is caused by .....

**B Write the scientific term of each of the following :**

1. A physical quantity equals planck's constant is multiplied by photon frequency.
2. A genital disease caused by spiral bacteria.

## 5

## Cairo Governorate

## Manarat Alfarouk Islamic Lang. School

**Answer the following questions :****Question**

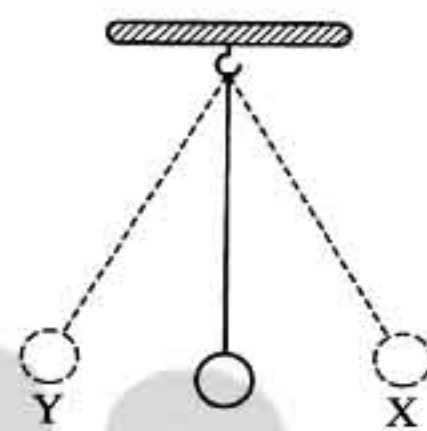
## 1

**A Choose the correct answer :**

1. An organ which is responsible for formation of ova in the flower is .....  
a. another.                      b. ovary.                      c. corolla.                      d. stamen.
2. The distance between the 2<sup>nd</sup> and 5<sup>th</sup> crest in the transverse wave is 60 cm. so the wavelength of this wave is .....  
a. 0.2 m.                      b. 0.2 cm.                      c. 20 cm.                      d. a, c are right
3. Sound wave travels in air with velocity of 340 m/s. and its frequency is 20 Hz. the wavelength of it is .....  
a. 14 cm.                      b. 170 cm.                      c. 170 m.                      d. 1700 cm.



4. The artificial vegetative reproduction is done in plants by .....
- a. cutting.                      b. grafting.                      c. tissue culture.                      d. all the previous.
5. All the following are factors affecting sound intensity except .....
- a. density of the medium.                      b. wind direction.                      c. wavelength.                      d. amplitude.
6. Noise intensity is measured in .....
- a. Hertz.                      b. watt/m<sup>2</sup>                      c. decibel.                      d. m/sec.
7. The absolute refractive index of any material is always .....
- a. More the one.                      b. equals one.                      c. less than one.                      d. negative.
8. In the opposite figure :  
when the ball of the pendulum moves from (X) to (Y) in a duration of 0.02 seconds, the frequency equals ..... Hertz.
- a. 0.04                      b. 0.02                      c. 25                      d. 50



**B What is meant by ... ?**

1. The amplitude of transverse wave is 5 cm.
2. Absolute refractive index of glass is 1.5.
3. Sound intensity at a point is 100 watt/m<sup>2</sup>.

**C Calculate the number of teeth in savart's wheel gear rotated by 360 cycles in one minute and half, if the frequency of sound equals 500 Hz.**

**Question**

**2**

**A Write the scientific term of the following :**

1. An oval shaped gland produces male gametes.
2. The ability of the medium to refract light rays.
3. The number of complete oscillations in one second.
4. Sound waves their frequency is more than 20000 Hz.
5. Short stem where the leaves developed modified into reproductive organs.
6. Incident ray, reflected ray and normal line, all locate in one plane which is perpendicular on reflecting surface.

**B Compare between :**

1. Androcium and Gynocium.
2. Transverse wave and Longitudinal wave.
3. Sound pitch and Sound intensity.



## PART

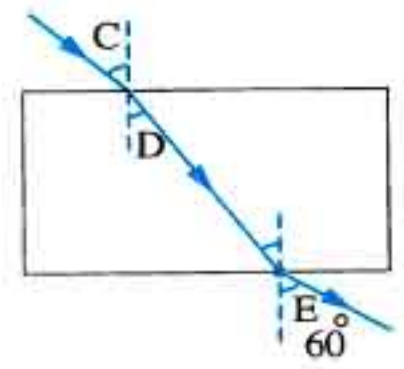
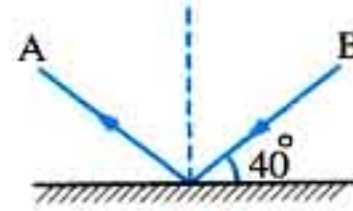
## 3

## C From the following figures :

Find : 1. Angle between A, B rays.

2. Mention the name of :

Angle (D) / Angle (E) then detect the measure of angle (C)



## Question

## 3

## A Give a reason for :

1. Presence of scrotal sac including testes outside the body.
2. We see lightning before hearing thunder.
3. Pollen grains have half of hereditary substance in their nuclei.
4. Sounds may be different even they are equaled in both pitch and intensity.

## B Extract the unsuitable word, then write the relation between the rest of the words :

1. Sepals – Tubers – Petals – Carpels.
2. Wave velocity – Wave frequency – Wave amplitude – Wavelength.
3. Sperm – Ovum – Leaf – Pollen grain.

## C Mention one use of :

1. Ultrasonic waves.

2. Resonance box.

## Question

## 4

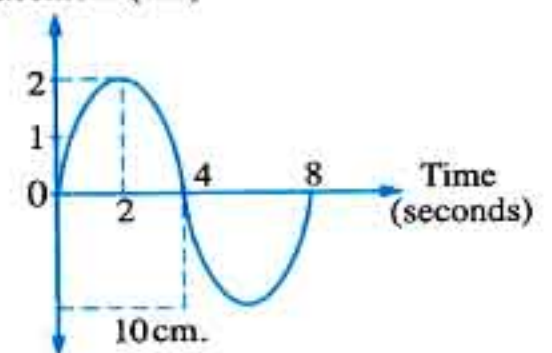
## A Correct the underlined words :

1. The angle of incidence equals half the angle of reflection.
2. Fusion between sperm and ovum is called pollination.
3. Changing light ray path on facing transparent object is considered light reflection.
4. Reproduction by tubers can be used in apples and pears.
5. Coloured flowers are used in pollination by air.
6. As the density of medium decreases, amplitude increases.

## B From the following figure find :

1. Amplitude.
2. The wave velocity.

Displacement (cm.)



## C What will happen when ... ?

1. Incident light ray falls perpendicular on the reflecting surface.
2. Pollen grain falls on stigma of flower.
3. The distance between sound source and listener is decreases to half.



## Additional questions

## A What is meant by ..... ?

The inverse square law of sound.

## B What happens when ..... ?

1. A compact disc (CD) with shiny side is put to face sunlight.
2. The wound of recently laboured mother is infected by spherical bacteria.

6

Giza Governorate

6 of October Educational Directorate

Answer the following questions :

Question

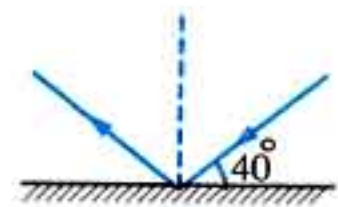
1

## A Mention the scientific term :

1. Motion made a body around its point of rest, where the motion is repeated through equal intervals of time.
2. The number of complete oscillations produced by the oscillating body in one second.
3. The reflection in which the light rays recoil in one direction when incident on a glistening surface.
4. Changing the path of light when travel from a transparent medium to another transparent medium of different optical density.
5. The incident light ray, reflected light ray and the normal all locate in one plane perpendicular to the reflecting surface.
6. A new method to produce large numbers of plants from a small part of it.

## B In this figure find :

1. Angle of incidence.
2. Angle between incident ray and reflected ray.



## C Mention one function for :

1. Flower calyx.
2. Flower anthers.

Question

2

## A Complete the following :

1. Waves are classified according to the ability to propagate and transfer energy into ..... and ..... waves.



2. Angle of refraction is the angle between the ..... light ray and the normal at point of incidence on separating surface.
3. The cell resulting from fusion of pollen grain and ovum nucleus is called .....
4. Human testes produces ..... hormone but female ovary produces ..... hormone and progesterone hormone.
5. Asexual reproduction in plants are classified into ..... and ..... vegetative reproduction.

**B** Savart's wheel rotates with a rate of 300 cycles per minute. A sound of frequency 600 Hz is produced when an elastic plate touches the teeth of the gear. Calculate the number of teeth of the gear.

**C** What is meant by ... ?

1. Absolute refractive index of water is 1.33
2. Periodic time.

### Question

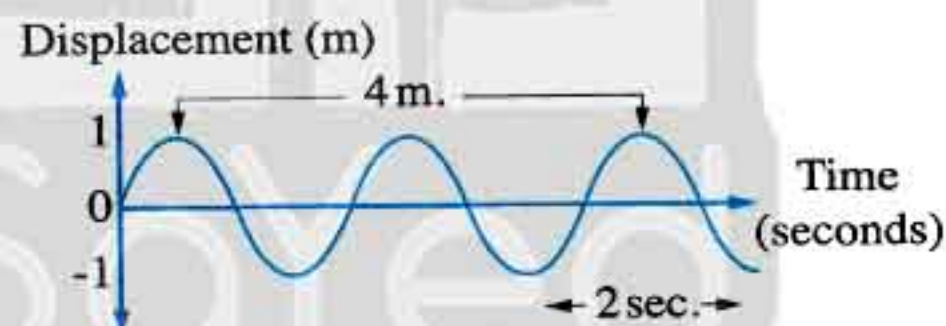
3

**A** Correct the underlined word :

1. Unit of sound intensity is Hertz.
2. Harmonic tones companying the fundamental tone lower in pitch.
3. The wall of the ovule after fertilization forms the wall of the fruit.
4. Reproduction by tuber happens in orange and naring.

**B** From the opposite figure, find :

1. Amplitude.
2. Frequency.
3. Wavelength.



**C** Give reason for :

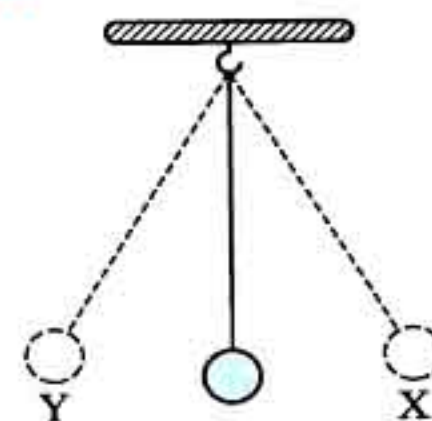
1. Palm plant is unisexual.
2. The light ray that is incident perpendicular on a glistening surface reflects on itself.

### Question

4

**A** Choose the correct answer :

1. The result of multiplying frequency of an oscillation body its periodic time equals .....  
 a. variable value.      b. negative value.      c. constant value.      d. one.
2. In the opposite figure :  
 when pendulum moves form (X) to (Y) in duration of 0.02 seconds,  
 the periodic time equals ..... seconds.  
 a. 0.01      b. 0.04  
 c. 50      d. 100





3. Complete oscillation includes ..... displacements.  
a. 1                                      b. 2                                      c. 4                                      d. 6
4. All of the following are factors affecting sound intensity except .....  
a. Amplitude of vibration.                                      b. frequency.  
c. medium density.                                      d. wind direction.
5. Sound of frequency 200 Hz is ..... than sound of frequency 100 Hz.  
a. sharper                                      b. stronger                                      c. harsher                                      d. weaker
6. The plant ovary produces .....  
a. Polen grains.                                      b. ovum.                                      c. sperms.                                      d. ovule.
7. .... is a short stem where leaves developed and modified into reproductive organs.  
a. Tuber                                      b. Flower                                      c. Stock                                      d. Scion
8. The colorful and scented flower leaves are called .....  
a. sepals.                                      b. stamens.                                      c. carpels.                                      d. petals.

**B Cross the odd word out. Then, state the relation among the remaining words :**

1. Sound wave – Light wave – Radio wave – Infrared wave.
2. Pendulum motion – Spring motion – Rotary bee motion – Stretched string motion.
3. Cuttings – Pollination – Tissue culture – Grafting.

**Additional questions**

**A Complete the following statements :**

1. Light travels through the ..... media in ..... lines.
2. The incubation period of puerperal sepsis disease is ..... , while that of syphilis disease is .....

**B Write the scientific term :**

A disease, whose symptoms appear as a rashes on the bach and hands of the patient.

**7**

**Giza Governorate**

**Abo El-Nomrous Educational Directorate**

**Answer the following questions :**

**Question**

**1**

**A Complete the following :**

1. Sound waves are longitudinal waves because particles of the medium vibrate ..... the direction of wave propagation.
2. The light reflection is classified in two types which are ..... and .....



## PART

## 3

3. Testes produce ..... and secrete ..... hormone.
4. From properties of light is that light travels in ..... lines.
5. Each ovary produce one ovum each ..... days, in exchange with the other ovary.
6. The frequency of the oscillation body is measured by unit called .....
7. The measuring unit of sound intensity is ..... while that of noise intensity is .....

**B What happens when ... ?**

1. A light ray falls perpendicular on the reflecting surface.
2. When a pollen grain falls on stigma of a flower.

**Question****2****A Choose the correct answer for the following statements :**

1. A pencil partially immersed in water appears broken due to the ..... of light energy rays.  
a. refraction                      b. reflection                      c. analysis
2. The angle of incidence of light ray is  $30^\circ$ , so the angle of reflection is .....  
a.  $30^\circ$                               b.  $60^\circ$                               c.  $90^\circ$
3. The human ear can not hear sound of frequency .....  
a. 50 Hz.                              b. 300 Hz.                              c. 10 Hz.
4. The male reproductive organ in flower is .....  
a. gynoecium.                      b. androecium.                      c. corolla.
5. .... is (are) mechanical waves.  
a. Water waves only              b. Sound wave only              c. Both a, b
6. The ovum contains ..... of the genetic material of the plant species.  
a. half                                  b. all                                  c. quarter
7. The artificial vegetative reproduction is done by .....  
a. cutting.                              b. grafting.                              c. all the previous.
8. Velocity of sound in air equals ..... m/s.  
a. 340                                  b. 1500                                  c.  $3 \times 10^8$

**B Mention the importance of :**

1. Jacuzzi.
2. Ovary in female human.

**C Compare between :**

Oscillatory and wave motion (definition only).

**Question****3****A Write the scientific term for each of the following :**

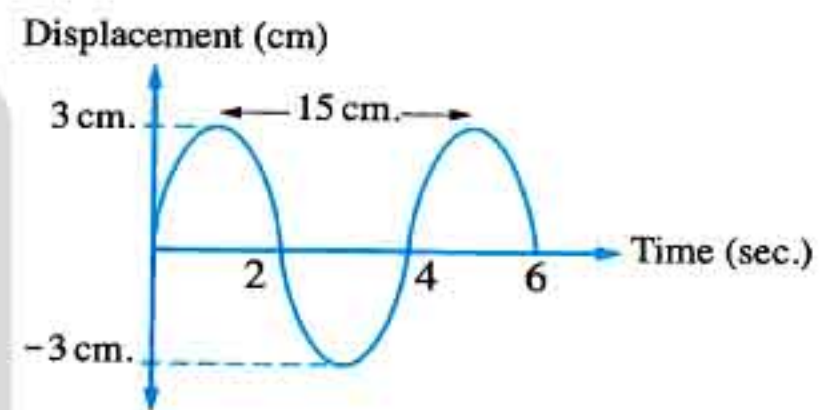
1. Short stem where the leaves developed into reproductive organs.



- The reproduction by some plants part as roots, stem, leaves.
- The ability of medium to refract light rays.
- A phenomenon that appears in the desert as a result of refraction and reflection of light.
- A new method of producing large numbers of plants from small part of it.
- The motion which regularly repeated in equal periods of time.
- Fusion of male and female gametes to form zygote.
- A property by which ear can distinguish between rough and sharp voices

**B Calculate :**

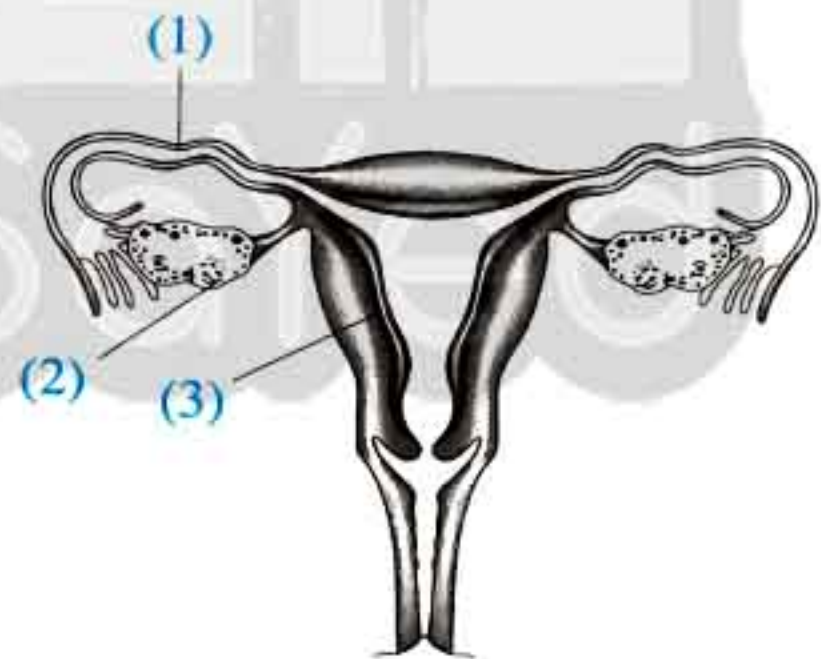
- Amplitude = .....
- Wavelength = .....
- Periodic time = .....
- Wave velocity = .....

**C Give reason for :**

- The petals of corolla are coloured and scented.
- Ultrasonic waves are used in sterilization of food.

**Question 4****A Look at the opposite diagram then, answer :**

- The name of this diagram ?
- The structure in which secrete progesterone is number .....
- The structure in which fertilization occur is number .....
- The structure in which fetus grow is number .....

**B Put (✓) or (✗) and correct the wrong ones :**

- The typical flower contains three whorls. ( )
- Light waves are electromagnetic transverse wave. ( )
- Vas deference stores the sperms. ( )
- Sound intensity increase as amplitude increase. ( )

**C If you know that water waves propagate with velocity 8 m/sec. and they make 20 waves in 5 sec., Calculate the distance between the first and third crest of these wave.**



## Additional questions

## A Choose the correct answer :

1. .... colour has the lowest deviation.

a. Violet

b. Green

c. Red

d. Yellow

2. An ulcer at the tip of the penis in male is due to ..... infection.

a. syphilis

b. gonorrhea

c. puerperal sepsis

d. german measles

## B Give reasons for :

Preventing visits of persons who suffer from respiratory diseases to the mother after delivery.

8

Giza Governorate

El-Sheikh Zayed Educational Directorate

Answer the following questions :

Question

1

## A Complete the following statements :

1. The angle of incidence ..... the angle of reflection.

2. In the ..... waves, the particles of the medium vibrate perpendicular to the direction of wave propagation.

3. The ..... are small cells that formed in the anther of the flower.

4. Sound ..... is the property by which the ear can distinguish between sharp or rough sounds.

5. The male sex hormone is called .....

6. The sound intensity at a point is ..... proportional to the square of the distance between this and the source of sound.

## B Calculate the frequency of a simple pendulum which makes 600 complete oscillations in 30 seconds.

Question

2

## A Put (✓) or (×) :

1. Sound can be heard from all directions that surround the sound source. ( )

2. The flower that contains male and female reproductive organs is called female flowers. ( )

3. Sound intensity increases when the wind and sound waves are in the same direction. ( )

4. The absolute refractive index for any transparent medium is less than 1 ( )



5. The light is a mechanical wave. ( )

6. The seminal vesicles, prostate gland and cowper's glands are associated to the male reproductive system. ( )

**B What is meant by ... ?**

1. Amplitude.

2. Fertilization.

**C Correct the underlined words :**

1. Growing leads to continuity of the living organism .

2. Sonic wave are used in sonar device and breaking down stones of kidney.

3. When the sound source touches a resonance box, the sound intensity decreases.

4. The swing and tuning fork are example of wave motion.

**Question**

**3**

**A Write the scientific term for each of the following :**

1. The returning back of light waves to the same medium of incidence when they meet a reflecting surface.

2. The female reproductive organ of the flower.

3. The number of complete oscillations produced by the oscillating body in one second.

4. The tones that accompany the fundamental tone, but they are higher in pitch and lower in intensity.

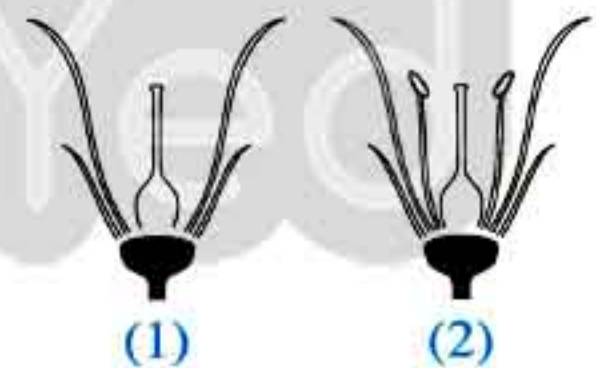
5. The transferring of pollen grains from the anther of the flower to the stigma.

6. The distance between two successive compressions or rarefactions in a longitudinal wave.

**B Mention the sex in each flower from the following :**

– Flower (1)

– Flower (2)



**Question**

**4**

**A Give reasons for each of the following :**

1. Hearing thunder after seeing lightning in spite of they both happen at the same time.

2. The pencil in a cup of water seems broken.

3. The petals of corolla are coloured and scented.

**B Choose the correct answer :**

1. From artificial vegetative reproduction .....

a. cutting.

b. grafting.

c. tissue culture.

d. (a) , (b) and (c).

2. Calyx consists of a group of green leaves each of them is called .....

a. sepal.

b. carpel.

c. petal.

d. micropyle.



## PART

## 3

3. The speed of sound wave is measured in a unit known as .....
- a. Hz.                                      b. Watt/m<sup>2</sup>                                      c. m/sec.                                      d. Decibel.
4. If the angle between the incident light ray and the reflecting surface is 30°, so the angle of reflection equals .....
- a. 30°                                      b. 60°                                      c. 90°                                      d. 180°
5. The result of multiplying frequency of an oscillating body by its periodic time equals .....
- a. one.                                      b. negative value.                                      c. constant value.                                      d. variable value.
6. A natural phenomenon takes place on the desert roads at noon due to reflection and refraction of the light .....
- a. lightning.                                      b. thunder.                                      c. mirage.                                      d. rainbow.
- C Calculate the frequency of a musical tone similar to the frequency of a produced tone using Savart's wheel rotated with a velocity of 100 cycles in 50 seconds. given that the number of teeth of the gear is 30 teeth.**

## Additional questions

**A Complete the following statements :**

1. As the distance between the light source and the surface increases twice, the intensity of light of the surface ..... to its .....
2. Syphilis disease can be transmitted from pregnant woman to her fetus through the ..... or during the .....

**B What is meant by .... ?**

Analysis of light.

## 9

## Giza Governorate

Talaee Islamic Language School

Answer the following questions :

## Question

## 1

**A Complete the following sentences :**

1. The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.
2. Each carpel consists of a swollen part called ovary which connects with tube called ..... and ending in .....
3. The frequency of sonic waves ranges between ..... Hz and ..... Hz
4. The two testes function is to produce ..... and secrete ..... hormone.



**B What is meant by ... ?**

1. Wavelength of a sound wave is 30 cm.
2. The number of complete oscillations made by an oscillating body in 10 sec. is 500 complete oscillations.
3. Absolute refractive index of water is 1.33

**Question 2****A Write the scientific term for each of the following :**

1. The maximum displacement of medium particles away from their original position.
2. Short stem where the leaves developed and modified into reproductive organs.
3. Changing the path of light when travels from a transport medium to another transparent medium of different optical density.
4. Process of fusion of the nucleus of pollen grain with the nucleus of ovum to form the zygote.

**B What happens when ... ?**

1. A light ray falls on a rough surface.
2. A light ray travels from a transparent medium of higher optical density to another of lower optical.

**C Mention one use or function :**

1. The calyx.
2. Ultrasonic waves in industrial field.

**Question 3****A Give reason for :**

1. Sound intensity in the presence of carbon dioxide as a medium is higher than that in air.
2. Water waves are mechanical transverse waves.
3. Pollen grains of wind pollinated flowers are produced in a huge number.
4. The oscillatory motion is considered as a periodic motion.

**B Put (✓) or (✗) and correct the wrong ones :**

1. If the angle between the incident light ray and the reflecting surface is  $35^\circ$ , so the angle of reflection is  $35^\circ$  ( )
2. From the ways of artificial vegetative reproduction are cutting, grafting and tubers. ( )
3. The sound velocity through solids is less than that through liquids. ( )

**Question 4****A Choose the correct answer :**

1. The unit of measuring sound intensity is .....  
 a. m/sec.                      b. watt/m<sup>2</sup>                      c. decibel.                      d. no correct answer.



## PART

## 3

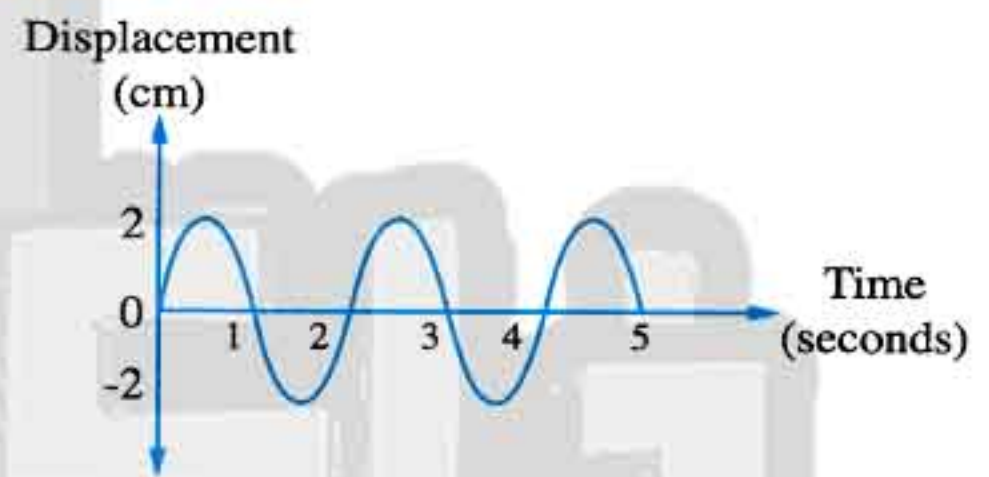
2. All of the following are electromagnetic waves except ..... waves.  
 a. light                      b. sound                      c. x-rays                      d. radio
3. If the distance between the centre of the third compression and that of the sixth compression on the wave propagation is 15 cm., the wavelength of this waves is .....  
 a. 5 cm.                      b. 30 cm.                      c. 7.5 cm.                      d. 3.75 cm.
4. After fertilization the ovary develops and becomes the .....  
 a. flower.                      b. fruit.                      c. seed.                      d. embryo.

**B Compare between each of the following :**

- Self pollination and mixed pollination.
- Sound of man and sound of woman. (according to sound pitch and frequency)

**C The opposite figure represents an oscillatory motion. Find :**

- Amplitude.
- Periodic time.
- Frequency.
- Time on one amplitude.

**Additional questions****A Choose the correct answer :**

- The photon energy = Planck's constant  $\times$  .....  
 a. photon frequency.                      b. photon velocity.  
 c. light intensity.                      d. no correct answer.
- All of the following are sexual transmitted diseases except .....  
 a. gonorrhea.                      b. syphilis.  
 c. prostate cancer.                      d. AIDS.

**B Rewrite the following statements after correcting the mistakes :**

- Violet colour has the longest wave length.
- Light travels in transparent media in the form of zigzag lines.



10

Alexandria Governorate

Middle Educational Directorate

Answer the following questions :

## Question

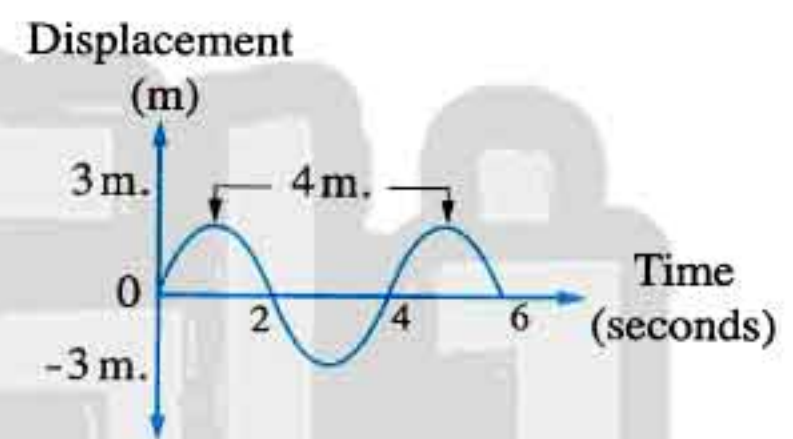
1

A Write the scientific term for the following :

1. The point of the highest density and pressure in longitudinal wave.
2. A property by which the human ear can distinguish between harsh and sharp voice.
3. The angle between the emergent light ray and the normal.
4. The transfer of pollen grains from the anther of a flower to the stigma of the same flower.
5. A group of glands their function is to secret semen.
6. A new method to produce large numbers of plants from small part of it.

B From the opposite figure, find :

1. Amplitude.
2. Periodic time.
3. Frequency.
4. Wavelength.
5. Wave velocity.



C What happens in the following cases ... ?

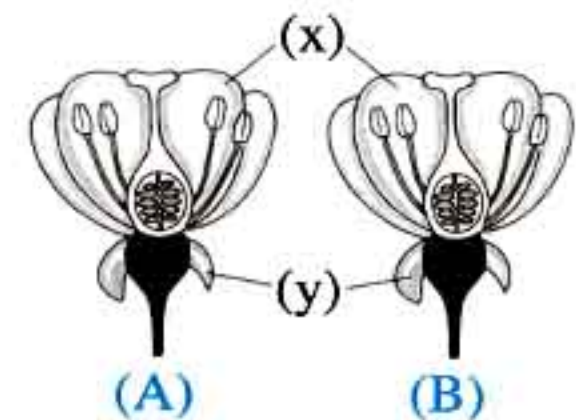
1. The vibration of the particles of a medium in perpendicular to the direction of wave propagation.
2. To incident light ray falls of rough surface.

## Question

2

A The opposite figure shows two flowers of two plants from the same species :

1. What is the name of parts (x) and (y) ?
2. Mention the function of parts (x) and (y) ?
3. What is the sex of flowers (A) and (B) ?



B In the following cross out the odd word, then mention the scientific term of the rest :

1. Pedulum motion – Spring motion – Rotary bee motion – Stretched string motion.
2. Anther – Filament – Pollen grains – Style.

C Define the following :

1. Wave motion.
2. Mirage.



## PART

## 3

## Question

## 3

## A Choose the correct answer :

- The doctors use waves with a frequency ....., to break down kidney's stones.  
a. Less than 20 Hz      b. 20 Hz      c. more than 20 kHz
- Sound intensity in air is ..... that in carbon dioxide.  
a. less than      b. more than      c. equal to
- When light ray passes from air to glass it refracts ..... the normal.  
a. away from      b. near to      c. perpendicular to
- The absolute refractive index of any materials is always ..... one.  
a. less than      b. more than      c. equal
- The flower is a modified .....  
a. stem.      b. root.      c. leaf.
- All the following are single seed fruit except .....  
a. apricot.      b. peaches.      c. peas.

## B Mention the use or function of the following :

- Jacuzzi.
- Fallopian tubes.

## C Compare between the following :

- Mechanical waves and electromagnetic waves concerning the medium.
- The ovum and the sperm concerning the size.

## Question

## 4

## A Complete the following statements :

- The amplitude equals ..... of a complete oscillation.
- Sound is produced from ..... of bodies.
- The measuring unit of sound intensity is .....
- The natural vegetative reproduction in potatoes is done by .....
- The first cell produced from the fusion of the pollen grain with the ovum nucleus is called .....
- The ..... hormone in males is responsible for the appearance of signs of puberty.

## B Give reasons for the following :

- The piano sound differs from that of a violin if they have the same sound properties.
- The pen seems broken, when it is put in a glass of water.
- The stigma of air pollinated flowers are feathery like and sticky.

## C Calculate the frequency of a musical tone produced from a savart's wheel rotating with a velocity of 960 revolution in 2 minutes, knowing that the number of gear teeth = 30



## Additional questions

## A Complete the following statements :

1. .... is the nearest colour to the prism apex, while .... is the nearest colour to the prism base.
2. From the complications of syphilis disease is the appearance of .... in different body parts like .... and bones.

## B Write the scientific term :

1. A genital disease, which is caused by spherical - shaped bacteria.
2. A mixture of seven spectrum colours.

## 11 Alexandria Governorate

Taymour English School

Answer the following questions :

## Question

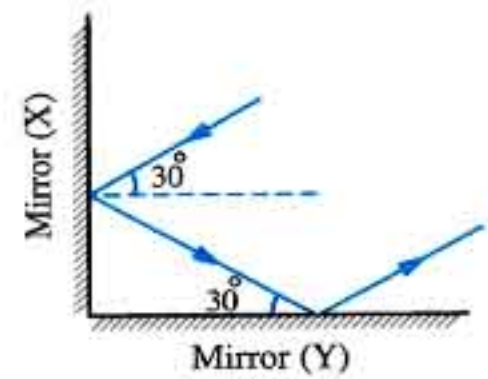
1

## A Choose the right answer :

1. After fertilization, the ovule develops into .....  
a. ovary.                      b. fruit.                      c. seed.                      d. seed coat.
2. Each complete oscillation consists of ..... amplitudes.  
a. 3                      b. 4                      c. 2                      d. 5
3. The measuring unit of noise intensity is .....  
a. Hertz.                      b. Watt/m<sup>2</sup>.                      c. Cycles/sec.                      d. Decibel.
4. The number of whorls in ♂ flower is .....  
a. 2                      b. 3                      c. 4                      d. 5
5. The light waves propagate ..... the direction of propagation.  
a. along                      b. right                      c. left                      d. perpendicular
6. In ♂ human; the ..... testes are surrounded by .....  
a. 2-sperms.                      b. 3-scrotal sac.                      c. 2-scrotal sac.                      d. 2-fallopian tubes.
7. .... is responsible for harshness of sound in male human.  
a. Estrogen                      b. Testosterone                      c. Progesterone                      d. Seminal fluid
8. We can hear all of the following sounds except .....  
a. 40 Hz.                      b. 60 KHz.                      c. 10 KHz.                      d. 60 Hz.



9. The angle of reflection on mirror (y) is .....
- a.  $40^\circ$                                       b.  $30^\circ$
- c.  $60^\circ$                                       d.  $90^\circ$
10. If we multiply the periodic time by the frequency :  
the result will be .....
- a. less than 1                                  b. 1
- c. zero    d. more than 1



**B Compare between :**

1. Ovum and sperm
2. Sound and radio waves (concerning : drawing and the type of each of them).

### Question

## 2

**A** What are the results of the following :

1. Refraction of light from low optical dense medium to a higher optical dense one.
2. Passing of sound in  $\text{CO}_2$  and in air (Concerning sound intensity, Why ?)
3. Falling of light on a leaf.
4. Increasing number of sound waves and decreasing their amplitudes. (concerning sound pitch and sound intensity respectively)
5. Looking at a pencil immersed in water vertically with angle  $90^\circ$

**B Give a reason for :**

1. Absolute refractive index is always greater than one.
2. The presence of cilia in fallopian tubes of female reproductive organ.

### Question

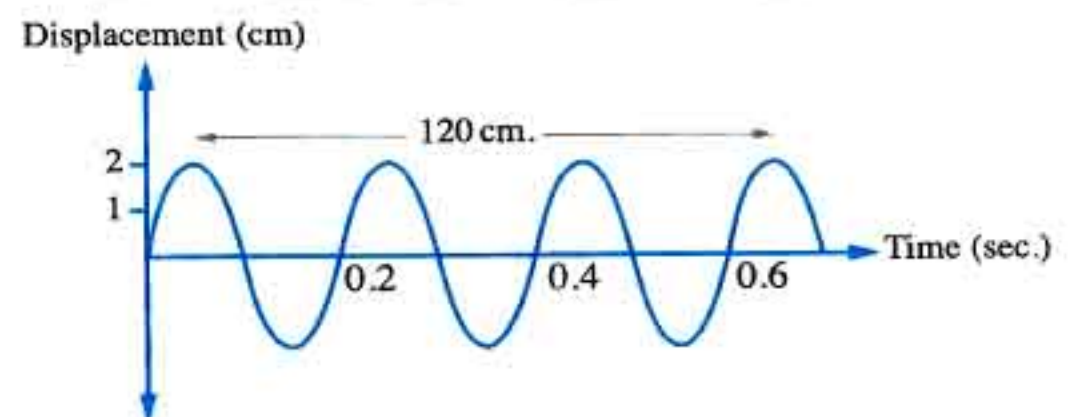
## 3

**A** Solve the following problems :

1. Solve the following problems :

**Calculate :**

- a. Wavelength.  
c. Frequency.  
e. Velocity of such a wave.
- b. Periodic time.  
d. Amplitude.



2. Find the frequency of unknown tone using Savart's wheel if the number of teeth of the gear used is 100 teeth and number of cycles done in 2 minutes are 300 cycles.

**B** Write the importance of :

1. Resonance box is some musical instruments.
2. Calyx.
3. Estrogen hormone.
4. Insects in pollination.



## Question

4

## A Write the scientific term :

1. The waves that cannot travel in vacuum.
2. The distance covered by sound in one second.
3. They are tones accompany the basic tones but they are lower in intensity and higher in pitch.
4. The waves that are used in sterilization of food, water and milk.
5. The intensity of sound at a point varies inversely with square the distance between that point and the sound source.

## B Complete the following :

1. Pollen grains which spread by wind are produced ..... in number and they are ..... in weight.
2. Sounds can be classified into 2 groups, musical tones of ..... frequency and noise of ..... frequency.
3. The stamen in flower consists of ..... and .....
4. When male gamete fuses with female gamete ..... is formed.
5. Rotary bee is an example of ..... but not an example of .....

## Additional questions

## A Choose the correct answer :

1. Light .....
 

|                               |   |
|-------------------------------|---|
| a. travels in straight lines. | b. consists of compressions and rarefactions. |
| c. can be analysed.           | c. (a) and (c) are correct.                   |
2. The microbe that causes the syphilis is .....
 

|                     |                        |
|---------------------|------------------------|
| a. spiral virus.    | b. spherical bacteria. |
| c. spiral bacteria. | d. spiral algae.       |

## B Put (✓) or (✗), then correct what is wrong :

Syphilis disease can be transmitted by droplets.

( )

12

Alexandria Governorate

East Educational Directorate

Answer the following questions :

## Question

1

## A Complete the following statements :

1. There are two type of periodic motion which are ..... motion and ..... motion.



## PART

## 3

2. The sound pitch is the property by which the ear distinguish between ..... and ..... voices.
3. Sexual reproduction in plants takes place in two successive processes which are ..... then .....
4. Waves are classified according to the type of direction of vibration of medium particles into ..... and .....
5. The fertilized ovum is called ..... which contains ..... pairs of chromosomes in human being.
6. When parallel light rays meet a rough surface, they reflect in ..... directions and this is called ..... reflection.

**B What is meant by ... ?**

1. The compression.
2. The frequency.

**Question****2****A Write the scientific term for each of the following :**

1. The maximum displacement done by the oscillating body.
2. The distance that is covered by the wave in one second.
3. The measuring unit of sound intensity.
4. The angle between the refracted light ray and the normal at the point of incidence on the separating surface.
5. An instrument used to determine the frequency of unknown sound tone.
6. A design composed of a tube, where water moves in the form of circular waves for treating sprains and cramps.
7. A group of glands, in the reproductive system, their function is to secrete seminal fluid.
8. A sac like structure that regulates and keeps the temperature of testes.

**B Give a reason for each of the following :**

1. The velocity of light changes from one medium to another.
2. The periodic time decrease as the number of complete oscillation increases.
3. The piano sound differs from that of a violin if they have the same sound properties.

**Question****3****A Put (✓) or (✗) and correct the wrong ones :**

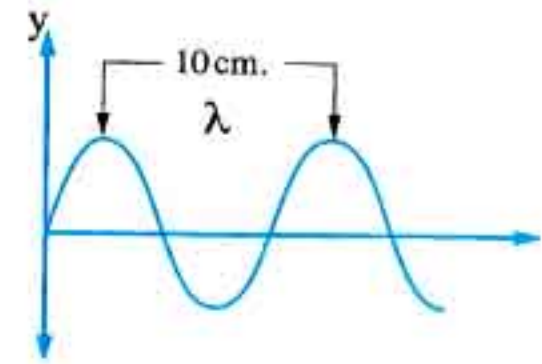
1. Each ovary produces only one ovum every 28 days in exchange with other ovary. ( )
2. The light ray refracts towards the normal when it travels from air to glass. ( )
3. In tissue culture, the tissue is separated from the lower part of the stem. ( )
4. The sound intensity decreases, when the source of sound touches an empty box. ( )
5. Sonic waves are used in sterilizing food substances. ( )



## Final Examinations

**B** Look at this figure, then answer the following :

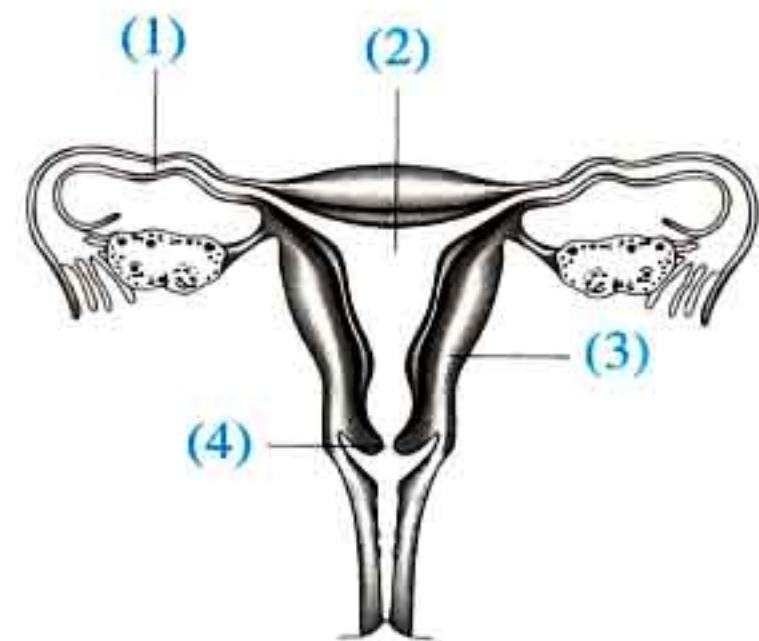
1. What is the kind of this wave ?
2. What is its velocity of propagation when it produces 600 vibrations in a minute ?

**Question 4****A** Choose the correct answer :

1. The ovum stores food and nutrients in the .....  
a. nucleus.      b. cytoplasm.      c. cellular membrane.      d. no correct answer.
2. Sperms transfer from the testes to the urinary genital duct through .....  
a. urethra.      b. epididymis.      c. vas deferens.      d. penis.
3. The zygote contains ..... of the genetic material of the plant species.  
a. half      b. all      c. quarter      d. no correct answer
4. The frequency of oscillating body is measured by a unit called .....  
a. Hertz.      b. Watt/m<sup>2</sup>.      c. Decibel.      d. m/sec.
5. Light refraction is due to the difference in ..... through different media.  
a. sound intensity      b. nature of the surface  
c. light velocity      d. all the previous answer.
6. The absolute refractive index of any material is always .....  
a. more than one.      b. less than one.      c. equal to one.      d. equal zero.
7. As the velocity of the rotation of the gear in savart's wheel decreases, the frequency decrease consequently the ..... of the sound decreases.  
a. type      b. pitch      c. amplitude      d. intensity
8. The pollen grains of flowers pollinated by wind are .....  
a. produced in huge number.      b. light in weight.  
c. dry.      d. (a), (b) and (c) are correct.

**B** In the opposite diagram :

1. Write the labeled from no (1) : (4)
2. What is the function of no (2) ?





## C Mention the way of natural or artificial vegetative reproduction :

| Plant           | The way of nature of artificial vegetative |
|-----------------|--|
| ..... (1) ..... | Grafting                                   |
| Potatoes        | ..... (2) .....                            |
| Sugar can       | ..... (3) .....                            |

## Additional questions

## A Complete the following statements :

1. The puerperal sepsis disease is caused by ..... bacteria, while syphilis disease is caused by ..... bacteria.
2. The light intensity of a surface is ..... proportional to square of the distance between the surface and the light source.

## B Give reasons for :

1. Formation of spectrum colours.
2. It is necessary to wear masks during labour process.

13

El-Qalyoubia Governorate

Memphis Language School

## Answer the following questions :

## Question

1

## A Complete the following sentences :

1. Frequency of sonic wave, ranges between ..... Hz and ..... Hz.
2. The reflection is classified into two types which are ..... and .....
3. The unit of sound intensity is ....., while the unit of noise intensity is .....
4. .... is considered the simplest form of oscillatory motion.
5. Calyx of a flower consists of green leaves called ..... but corolla consists of coloured leaves called .....
6. From the artificial vegetative reproduction in plant are ..... and .....
7. If the angle between the incident light ray and reflected light ray is  $100^\circ$ , so the angle of reflection = .....

## B Give reasons for the following :

1. Light can travel through free space.



2. Water waves are transverse mechanical waves.
3. Peach fruit contains only one seed.

- C Compare between transverse wave and longitudinal wave :**  
(concerning definition, components, wavelength and example)

### Question 2

- A Write the scientific term for each of the following :**

1. Light intensity at a point is inversely proportional to the square distance between light source and this point.
2. A phenomena that appears in desert as a result of refraction and reflection of light.
3. The distance covered by light in one second.
4. A flower that contains androecium only.
5. The fusion of the pollen grain with the ovum.

- B Savart's wheel rotates with a rate 300 cycle per minute. A sound of frequency 600 Hz is produced when an elastic plate touches the teeth of the gear. Calculate the number of teeth of the gear.**

- C Define :**

1. Pollination.
2. Light reflection.

### Question 3

- A What happens when ... ?**

1. Light fall perpendicular on a reflection surface.
2. The ovary of the plant after fertilization.
3. When a pollen grain falls on the stigma of a flower.

- B Choose the correct answer :**

1. all the following factors affecting sound intensity except .....  
a. amplitude.      b. frequency.      c. medium density.      d. wind direction.
2. If the angle between the incident light ray and the reflecting surface =  $40^\circ$ , so the angle of reflection = .....  
a.  $30^\circ$       b.  $40^\circ$       c.  $50^\circ$       d.  $60^\circ$
3. The sound of frequency 200 Hz is ..... than the sound of frequency 100 Hz.  
a. stronger      b. sharper      c. weaker      d. harsher
4. The floral whorl which is not found in the female flower .....  
a. calyx.      b. androecium.      c. corolla.      d. no correct answer.
5. The amplitude of the harmonic tone is ..... that of fundamental tone.  
a. smaller than      b. larger than      c. equal to      d. (a) and (b) are correct.

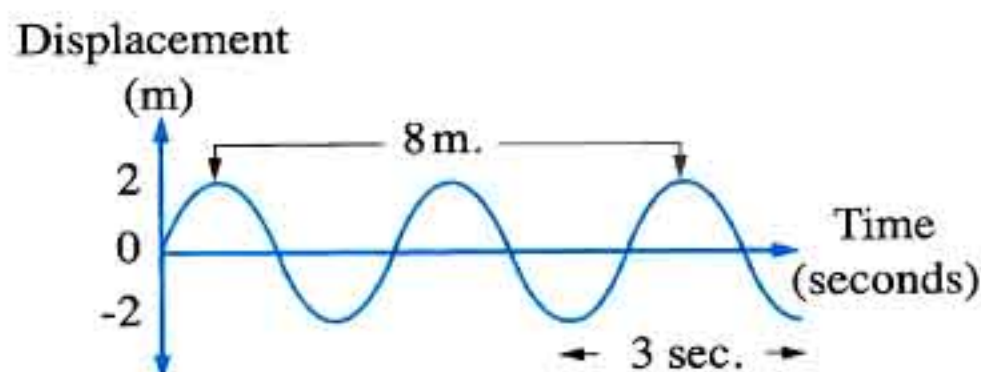


## PART

## 3

## C From the opposite calculate :

1. Wavelength.
2. Frequency.
3. Amplitude.
4. Wave velocity.



## Question

## 4

## A What is meant by ... ?

1. Sound pitch.
2. Sonic waves.
3. The absolute refractive index of water is 1.33

## B Put (✓) or (✗) and correct the wrong ones :

1. Drill is an example of musical tones. ( )
2. The wall of ovary after pollination forms the coat of the fruit. ( )
3. Man can't reproduce asexually. ( )
4. The sound quality is the property by which the ear can distinguish between strong and weak sound. ( )
5. The typical flower contains three whorls. ( )
6. The sound intensity increases as the amplitude increases. ( )

## C Mention one function :

1. Calyx of the flower.
2. Ovary.

## Additional questions

## A Choose the correct answer :

1. The incubation period of syphilis disease ranges from .....  
 a. 1 to 4 days.                      b. 1 to 4 weeks.  
 c. 2 to 3 days.                      d. 2 to 3 weeks.
2. The quanta of ..... colour has the lowest energy.  
 a. blue                      b. violet                      c. green                      d. red

## B What happens when ..... ?

The thickness of the transparent medium increases concerning the quantity of light that passes through it.



## 14 Sharkia Governorate

Omar Al-Farouk E.L.S.

Answer the following questions :

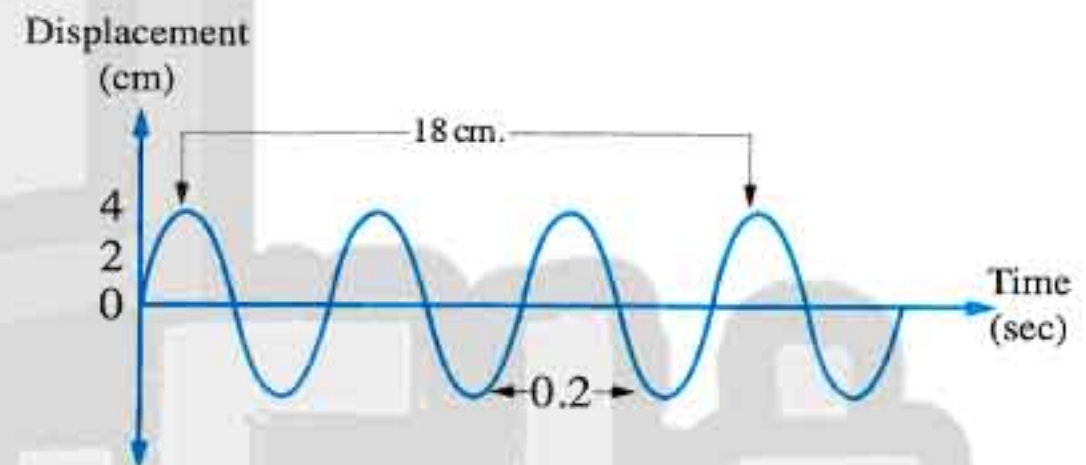
## Question 1

## A Complete the following sentences :

1. Voice of man is ..... and its frequency is .....
2. .... is a group of green leaves but ..... is a group of colored leaves.
3. When light ray travels from ..... to ..... it refracts near to the normal.
4. Velocity of oscillating body is ..... when it passes the rest point and is ..... away from the rest point.

## B Calculate from the figure :

1. Amplitude.
2. Periodic time.
3. Wavelength.
4. Frequency.
5. Wave velocity.
6. Number of complete waves.



## Question 2

## A Give reason for :

1. Palm flowers are unisexual.
2. Motion of rotary bee isn't oscillatory motion.
3. Absolute refractive index of any transparent medium is always greater than one.

## B Give one importance for :

1. Testosterone.
2. Ultrasonic.
3. Midpiece in the sperm.
4. A glass triangular prism.

## Question 3

## A Correct the underlined words :

1. Ovary extends from the uterus and ends by external genital opening.
2. Measuring unit of sound intensity is m/sec.
3. Grafting by wedge in which scion is attached to stock.
4. Oscillatory motion is the motion that is repeated regularly in equal time.
5. Light refraction is rebounding of light wave in the same medium.

## B Draw : The structure of ovum.

## C Calculate the frequency of sound produced by metallic plate of savart's wheel with a gear of 300 teeth if time taken by the wheel to make 500 rotations is 5 sec.



## PART

## 3

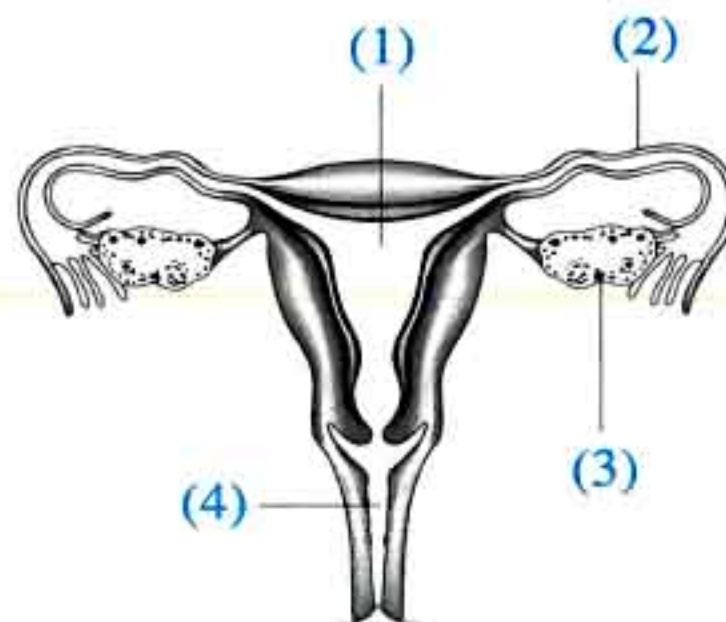
## Question 4

## A Compare between :

1. Transverse and longitudinal waves.
2. Sperm and ovum.
3. Sonic and infrasonic waves.

## B Study this figure, then answer the questions :

1. What does this figure represent ?
2. Replace the numbers in the figure by suitable labels.
3. What is the label in which the embryo is delivered to life ?



## C Calculate the wavelength of the sound wave propagating in sea water with velocity 1500 m/sec. knowing that the frequency of wave is 10 Kilohertz.

## Additional questions

## A Choose the correct answer :

1. Light can easily transmitted through ..... media.  
a. transparent      b. opaque      c. translucent      d. no correct answer
2. All of the following are symptoms of puerperal sepsis disease except .....  
a. high body temperature.      b. headache.      c. face paling.      d. chilling.

## B What happens when ..... ?

The recently laboured mother is subjected to air currents.

## 15 El-Menofia Governorate

Qesna Educational Directorate

Answer the following questions :

## Question 1

## A Complete the following sentences :

1. The sound velocity is measured in ..... unit while the sound intensity is measured in .....
2. .... and .... are from the features that indicate puberty in females.
3. The light reflection is classified in two types which are ..... and .....
4. Each testis in the human male is attached with a number of highly looped tubes known as .....
5. The bisexual flower contains ..... and ....., but the male flower contains ..... only.



**B** If sound waves have frequency 400 Hz in air and its wavelength is 85 cm., Calculate the velocity of the these waves.

**C** Mention one function for :

1. Calyx.

2. Testes.

### Question 2

**A** Write the scientific term for each of the following :

1. The angle between the incident ray path and the normal at the incidence point on the reflecting surface.
2. A flower that contains gynoecium only.
3. The maximum displacement made by the oscillating body away from its original point.
4. The distance covered by sound in one second.

**B** Give reasons for the following :

1. The light is considered an electromagnetic transverse wave.
2. The usage of ultrasonic waves to sterilize food.
3. The floor of the swimming pool appears higher than its original position.

**C** Compare between each of the following :

Ovum and sperm of human. (three points only)

### Question 3

**A** Choose the correct answer :

1. The organ responsible for formation the ova in the flower is the .....  
a. Ovary.                      b. anther.                      c. corolla.                      d. calyx.
2. The frequency of the oscillating body is measured by a unit called .....  
a. Hertz.                      b. Watt/m<sup>2</sup>.                      c. Decibel.                      d. m/sec.
3. The zygote contains ..... of the genetic material of the plant species.  
a. half                      b. all                      c. quarter                      d. third
4. If the angle between the incident ray and reflecting surface = 50, so the angle of reflection = .....  
a. 40                      b. 50                      c. 130                      d. 60
5. The artificial vegetative reproduction is done in plants by .....  
a. cutting.                      b. grafting.                      c. tissue culture.                      d. all the previous.

**B** What will happen for ... ?

1. Light ray falls perpendicular on reflecting surface.
2. Ovary and ovum after fertilization.
3. Light ray travels from a more optically dense medium to less optically dense medium.



## PART

## 3

## Question

4

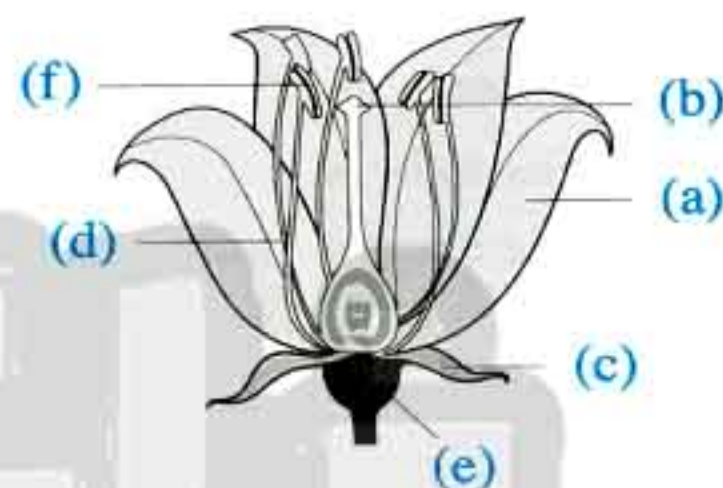
## A Put (✓) or (✗) and front of the following sentence then correct :

1. The frequency is the number of complete oscillations produced by the oscillating body in one second. ( )
2. The swing is an example for the wave motion. ( )
3. The periodic time is the time taken by the oscillating body to make half complete oscillation. ( )
4. The corolla is the male reproductive organ in the flower. ( )
5. The crest is the highest point in the transverse wave. ( )

## B What is meant by ... ?

1. The oscillating body makes 30 oscillations in one second.
2. Ultrasonic waves.

## C Mention the name of figure and complete the labels on the drawing :



## Additional questions

## A Complete the following statements :

1. An ulcer at the tip of the penis in male is due to ..... infection.
2. .... media don't allow light to pass through.

## B Extract the unsuitable word or statement , then write the relation between the rest :

1. AIDS / Gonorrhea / Syphilis / Measles.

16

Dakahlia Governorate

Educational Directorate

Answer the following questions :

## Question

1

## A Choose the correct answer :

1. The flower is a modified .....  
a. stem.                      b. leaf.                      c. root.                      d. branch.
2. The transverse waves consists of .....  
a. crests and compressions.                      b. compressions and rarefactions.  
c. crests and troughs.                      d. rarefactions and troughs.



3. .... hormone is responsible for the continuity of pregnancy.  
a. Testosterone      b. Estrogen      c. Thyroxin      d. Progesterone
4. The pollen grain nucleus contains ..... of the genetic material of the plant species.  
a. double      b. half      c. all      d. quarter
5. The partial immersed pencil in water looks broken because of light .....  
a. deviation.      b. reflection.      c. total reflection.      d. refraction.
6. After fertilization, the ovary develops forming the .....  
a. seed.      b. flower.      c. fruit.      d. leaf.

### B Complete the following statements :

1. The ..... motion made by the oscillating body around its of rest.
2. Sounds can be classified into two groups which ..... , .....
3. The sperm consists of ..... , midpiece and .....

### Question

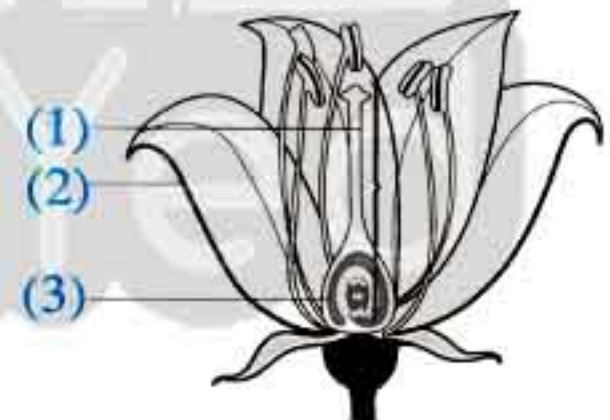
2

### A Put (✓) or (x) for each of the following :

1. The velocity of the oscillating body is maximum, when passing at rest position. ( )
2. The tuning fork oscillation is an example for the periodic motion. ( )
3. The human female's ovule is a settled sphere shaped cell. ( )
4. The bisexual flower contains only gynoecium. ( )
5. The particles of the medium vibrate along the direction of the wave propagation in the longitudinal wave. ( )
6. The associated glands in the male genital system secrets nutrients and acidic fluid. ( )

### B From the opposite figure answer the following questions :

1. Write the label on.
2. Mention the sex of the flower.
3. What kind of pollination in this flower.



### Question

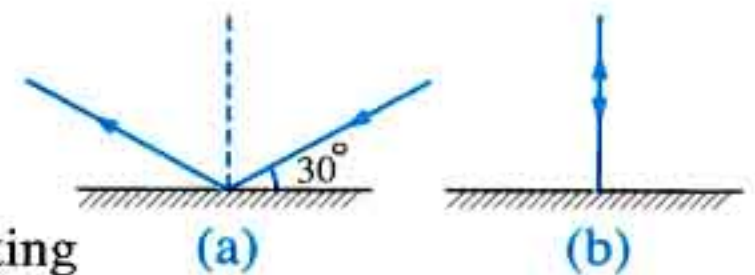
3

### A Give reasons for each of the following :

1. The absolute refractive index for any transparent medium is larger than one.
2. Flowers pollinated by insects produce coarse (rough) pollen grains.
3. Sound travelling in air has less intensity than that travelling in carbon dioxide.
4. The presence of testes outside the body in a sac-like structure called the scrotal sac.

### B Answer the following :

1. Find the values of the angle of the incidence and the angle of reflection in (a , b)
2. Calculate the periodic time and frequency for an oscillating body that makes 300 complete oscillations in half a minute.





## PART

## 3

## Question

4

## A Write the scientific term :

1. It is a natural phenomenon that takes place on the desert roads at noon especially in the summer times where objects on the road sides seem as if they had inverted images on wet area.
2. It is the maximum displacement done by the oscillating body away from its rest position.
3. It is a property by which the ear can distinguish between harsh and sharp voices.
4. The cell formed due to combination of sperm and ovum.
5. The reproduction of some plants by parts of the roots, stem or leaves.
6. It is the distance between the centres of two consecutive compressions or rarefactions.

## B Calculate the frequency of a musical tone similar to the frequency of an emitted tone using savart's wheel rotated with a velocity of 360 cycles in one minute, given that the number of teeth of the gear is 25 teeth.

## Additional questions

## A Put (✓) or (x) then correct what is wrong :

1. Uterine cancer is a genital disease which doesn't arise from sexual contact. ( )
2. Transparent media allow a part of light to pass through them. ( )

## B Give reasons for ... ?

1. The energy of violet photon is larger than that of blue photon.
2. Aluminium foil is an opaque medium.

17

Ismailia Governorate

Educational Directorate

Answer the following questions :

## Question

1

## A Complete the following sentences :

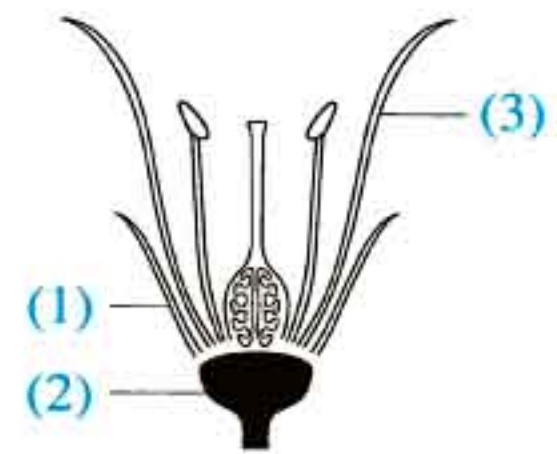
1. In ..... reflection, rays are reflected in one direction.
2. The ..... male hormone is responsible for appearance of secondary sex characters.
3. The complete oscillation include 4 displacements, each one is called .....
4. .... sound wave accompany the blowing of storms before rainfall.
5. After fertilization the ovary of the flower grows forming the .....
6. Sharp sound has ..... frequency than that of rough sound.
7. Measuring unit of sound intensity is .....



## Final Examinations

**B Give reasons for the following :**

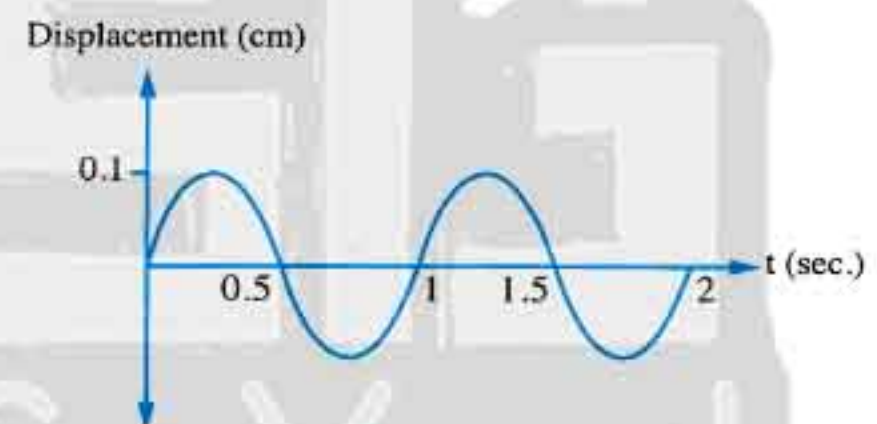
1. Sound waves are mechanical waves.
2. Absolute refraction index of any medium is always more than 1.
3. Fallopian tubes have funnel shaped opening and lined with cilia.

**C Complete the labels on the figure, and mention the sex of the flower.****Question****2****A Write the scientific term :**

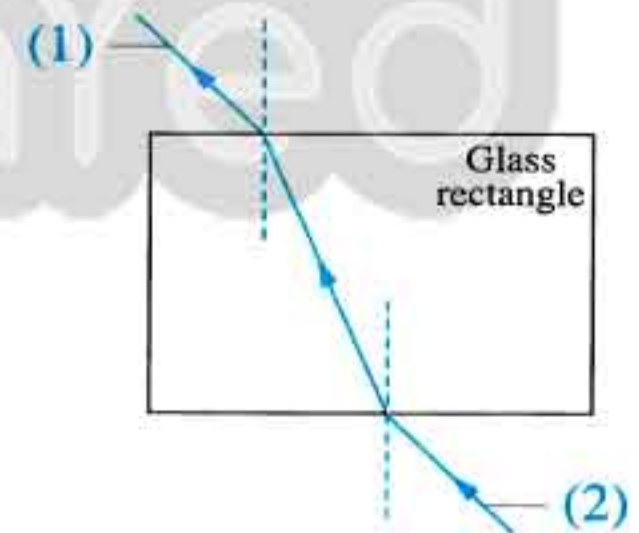
1. A property of sound by which the ear can differentiate between sounds from different sources, even if they have the same pitch & intensity.
2. An oval shaped gland that produces the male cells.
3. The highest point of the medium particles in transverse wave.
4. The ability of the medium to refract light.
5. The cell produced from fusion of male gamete and the ovum nucleus.
6. The direction of wave propagation.

**B Examine the figure then answer the questions :**

1. The amplitude .....
2. The periodic time .....
3. The frequency .....

**C Complete the labels on the figure :**

- (1) ..... ray.
- (2) ..... ray.

**Question****3****A Choose the correct answer :**

1. The result of multiplying frequency of body by its periodic time equals .....  
a. 1                      b. 0.5                      c. 0.1                      d. 4
2. All of the following are transverse waves except .....  
a. sound.                      b. light.                      c. radio.                      d. water.
3. In reproduction by grafting, a branch of the plant containing more than one bud, known as ..... is selected & attached to the already grown plant.  
a. stock                      b. scion                      c. bud                      d. no correct answer



## PART

## 3

4. The angle between the refracted ray and the normal at incidence point on the separating surface is called angle of .....

- a. incidence.                      b. refraction.                      c. reflection.                      d. emergence.

5. The left ovary in the female human produces one ripe ovum every ..... days.

- a. 28                      b. 30                      c. 56                      d. 7

**B What happens when ... ?**

1. The oscillating body passes its rest position during its movement. (concerning its speed).
2. Particles of the medium vibrate along the direction of wave propagation.
3. A light ray falls perpendicular on a reflecting surface.
4. The sperm has no tail.

**C Savart's wheel rotates with a rate of 300 cycles per minute, a sound of frequency 600 Hz is produced when a metallic plate touches one gear. find the number of teeth of the gear.**

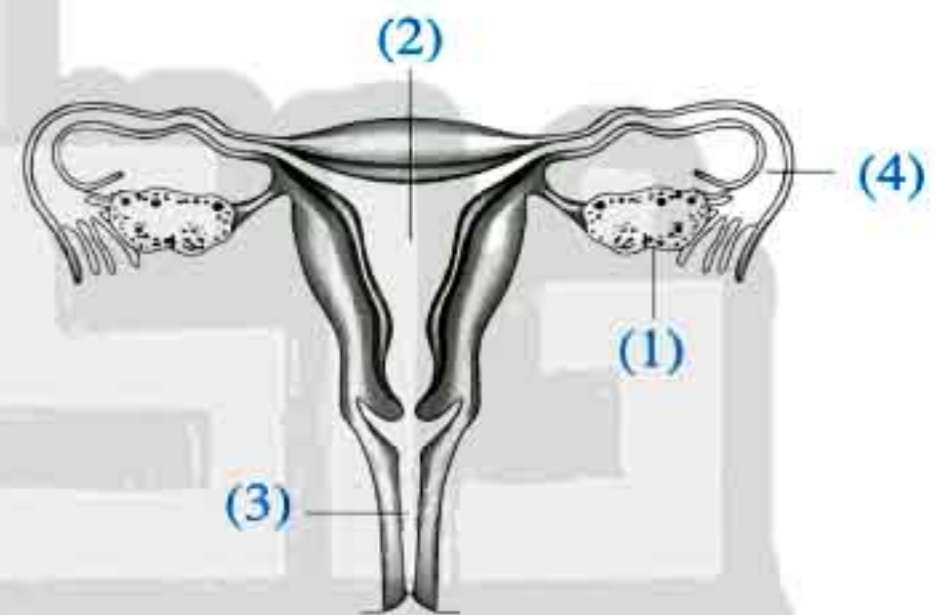
**Question**

**4**

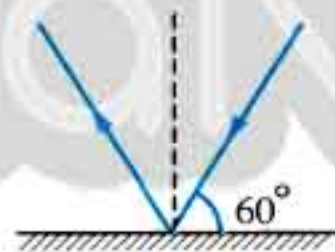
**A What is meant by each of the following ... ?**

1. Mixed (crossed) pollination.
2. The wavelength of sound waves is 30 cm.
3. The speed of wave.

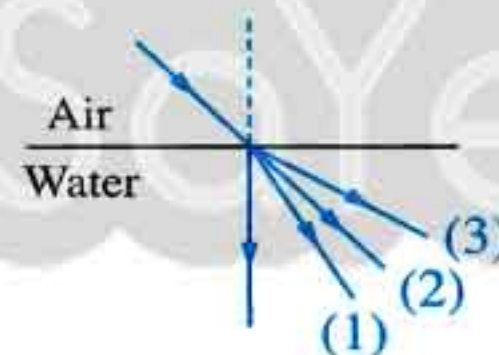
**B Complete :** The labels on the following figure and mention the name of the system.



**C Examine the following figures, then complete :**



1. Angle of reflection = .....



2. Which path is the right one, (1) or (2) or (3) ?

**Additional questions**

**A Choose the correct answer :**

The distance that light travels in a second is .....

- a. light frequency.                      b. light speed.  
c. light intensity.                      d. no correct answer.

**B Write the scientific term of each of the following :**

1. A structure used in the analysis of light.
2. A genital disease, which infects a recently labored mother.



## 18 Port-said Governorate

Education Directorate

Answer the following questions :

## Question 1

## A Complete the following statements :

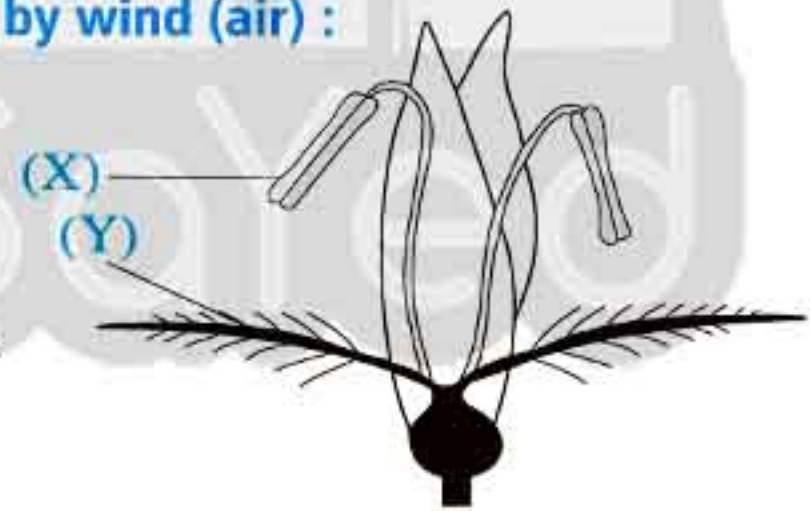
1. The ..... hormones in male and ..... hormones in female are responsible for the appearance of secondary sex characters.
2. The absolute refractive index of any transparent medium is always greater than .....
3. The outer whorl of the flower is called ..... which consists of .....
4. Intensity of sound at point varies ..... with square of the distance between that point and the second source.
5. Stamen of the flower consists of ..... and .....
6. Sharp tones have ..... frequencies, while rough tones have ..... frequencies.

## B Give reasons for :

1. We see lightning before hearing thunder.
2. The petals of corolla are colorful and scented.
3. Sound travelling in air has less intensity than that travelling in carbon dioxide.

## C The opposite figure shown a flower being pollinated by wind (air) :

1. Write the labels for (x) and (y).
2. Mention two characteristic that make this flower pollinated by wind.
3. Explain how cross pollination happens in this flower.



## Question 2

## A Choose the correct answer :

1. The human ear can hear sounds of frequency .....  
 a. 50 KHz.                      b. 30 KHz.                      c. 300 Hz.                      d. 10 Hz.
2. The right ovary in the female human produces a mature ovum every ..... days.  
 a. 24                                  b. 28                                  c. 34                                  d. 56
3. The result of multiplying the frequency of an oscillatory body by its periodic time equals .....  
 a. 1/2                                  b. 1/4                                  c. 1/3                                  d. 1



## PART

## 3

- B** Savart's wheel rotates with a rate of 300 cycle per minute. A sound of frequency 600 Hz is produced when an elastic plate touches the teeth of one gear, Calculate the number of teeth of the gear.
- C** What is meant by ... ?
1. Tissue culture of a plant root.
  2. The angle of refraction of a light ray =  $40^\circ$
  3. Sonic waves.
  4. Wavelength of a sound wave is 30 cm.

## Question

## 3

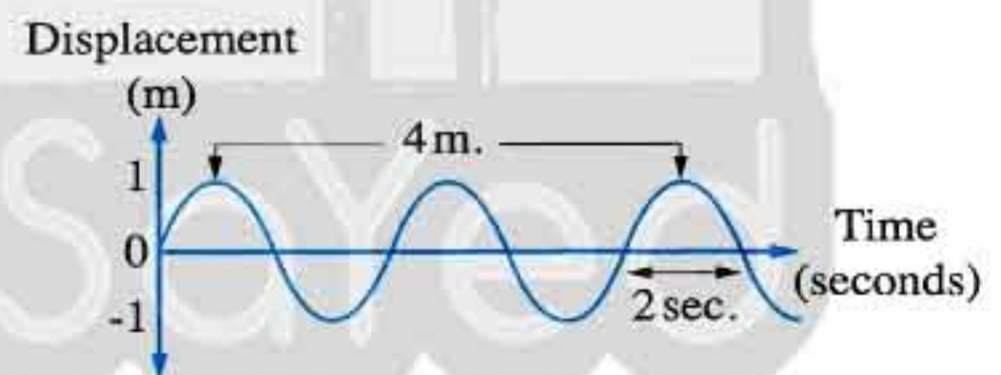
- A** Correct the underlined words :

1. The angle of incidence light ray is greater than of reflection.
2. The stamen consists of stigma, style and ovary.
3. The motion of tuning fork is a wave motion.
4. The sound velocity through liquids is less than that through gases.
5. Ovaries produce sperms and male hormone.
6. Light is mechanical transverse waves.

- B** Compare between : The ovum and the sperm (concerning the motion and size).

- C** From the opposite figure, find :

1. Wavelength.
2. Frequency.
3. Amplitude.
4. Wave velocity.



## Question

## 4

- A** Put (✓) or (✗) and correct the wrong :

1. Reproduction by tuber happens in orange and bitter orange. ( )
2. The progesterone hormone is responsible for pregnancy to continue. ( )
3. Sound intensity increases as the amplitude increases. ( )
4. The fish is seen lower than its real position in the fish tank. ( )
5. The human female's ovule is a settled sphere shaped cell. ( )
6. The transverse wave consists of compressions and troughs. ( )
7. Vas deferens stores the sperms. ( )
8. Bats, dogs and dolphins can hear ultrasonic waves. ( )



**B Choose from column (B) what suits column (A) :**

| A  | B  |
|--|--|
| 1. Protection of reproductive organs of the flower and has attractive color. | a. reflects on itself.   |
| 2. Distance covered by light in one second.                                  | b. the change of the path of a light ray when it moves between two media with different optical densities. |
| 3. Production of the sperms.   | c. protect the inner part of a flower.   |
| 4. Light refraction.   | d. male organ in a flower.   |
| 5. Androecium.   | e. testes.   |
| 6. The light ray falling perpendicular in the plane mirror.                  | f. corolla.  |
|  | g. speed of light.   |

### Additional questions

**A Complete the following statements :**

- ..... is the period between the beginning of infection and the appearance of disease symptoms.
- ..... and ..... are examples of the transparent media.

**B Rewrite the following statement after correcting the mistakes :**

The frequency of the green light is lower than that of yellow light

## 19 Damietta Governorate

Damietta Educational School

Answer the following questions :

### Question 1

**A Complete the following statements :**

- Harmonic tones are lower in ..... and higher in ..... than fundamental tones.
- Radio waves are considered ..... waves that propagate in space with a velocity of .....
- The absolute refractive index of any transparent medium is always ..... one.
- Artificial vegetative reproduction is carried out by ..... and .....
- The measuring unit of the frequency is ..... but the measuring unit of the noise intensity is .....
- The small green leaves protecting the inner parts of the flower is called .....

**B Mention one use (function) for each of the following :**

- Ultrasonic waves.
- Cowper's gland.
- Tissue culture.
- Placenta.



## PART

## 3

- C If the frequency of a sound wave is 200 Hertz and its wavelength equals 1.5 meter, Calculate : the velocity of sound propagation in air.

## Question

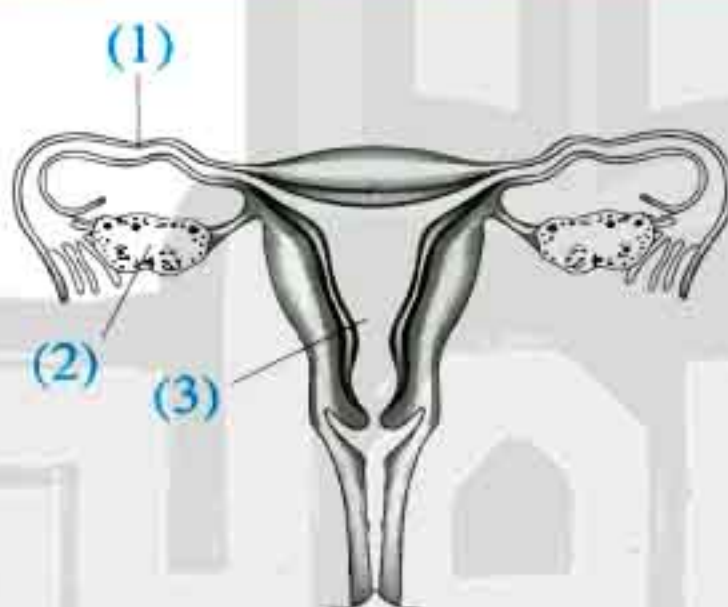
2

- A Write the scientific term for the following :

1. A flower that contains androecium and gynoecium.
2. A phenomenon that appears in the desert as a result of refraction and reflection of light.
3. Sound waves have frequency less than 20 Hz.
4. A part of the sperm that contains one half of the genetic material (chromosomes).
5. It is the pollination which is carries out by man.
6. The ability of the medium to refract light rays.

B

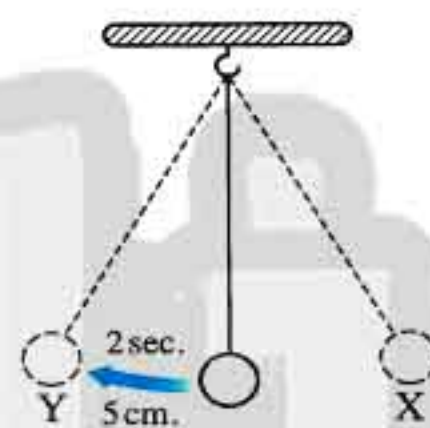
(a)



From the figure answer the following :

1. The figure represents .....
2. Write the labels (1) , (2) , (3).
3. What is the structure in which fertilization occur ?
4. What is the structure in which the fetus is growing ?
5. What is the structure which secretes estrogen ?

(b)



From the figure find :

1. Amplitude.
2. Periodic time.
3. Frequency.
4. Distance covered in a complete oscillation.

## Question

3

- A Choose the correct answer :

1. Zygote contains ..... of the genetic material of plant species.  
a. half                      b. all                      c. quarter                      d. three quarter
2. Rarefaction is the area of the medium, at which the medium particles .....  
a. don't vibrate.                      b. are too close to each other.  
c. are faraway from each other.                      d. vibrate up and down.
3. The angle between the incident light ray and the reflected light ray is  $40^\circ$ , so the angle of reflection is .....  
a.  $20^\circ$                       b.  $40^\circ$                       c.  $80^\circ$                       d.  $90^\circ$



## Final Examinations

4. The right ovary in the female human produces a mature (ripe) ovum every ..... days.

- a. 24                      b. 28                      c. 34                      d. 56

5. The human ear can hear sounds of frequency ..... KHz.

- a. 90                      b. 70                      c. 50                      d. 10

**B What is meant by ... ?**

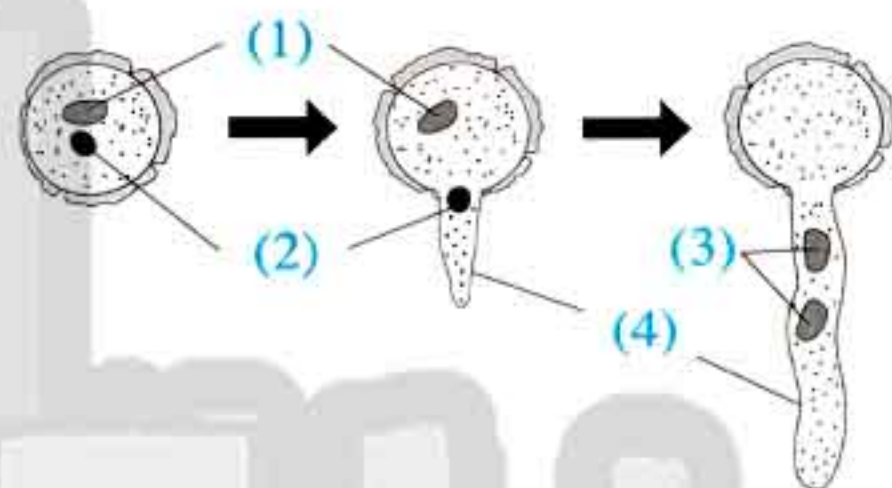
1. The angle of emergence.                      2. Sound pitch.                      3. Fertilization.

**C What happens in the following cases ... ?**

1. A light ray falls perpendicular on a reflecting surface.  
2. The middle part (midpiece) of a sperm is damaged.

**D From the figure answer the following ?**

1. The figure represents .....  
2. Write the labels (1) , (2) , (3) , (4)  
3. What happens when this structure falls on the stigma of a flower.



**Question 4**

**A Give reasons for :**

1. A light waves are considered electromagnetic waves.  
2. The inner wall of fallopian tubes is lined with cilia.  
3. Sound of man is harsh, while sound of woman is sharp.  
4. The presence of testes outside the body in the scrotal sac.

**B Compare between each of the following :**

1. Petunia flower and palm flower.  
2. Regular and irregular reflection of light.  
3. Transverse wave and longitudinal wave.

**C Correct the underlined words :**

1. Sweet potatoes is reproduced by grafting.  
2. The sound intensity decreases by increasing the density of the medium and vice versa.  
3. The testosterone hormone is responsible for the continuity of pregnancy.

**Additional questions**

**A Put (✓) or (x) then correct what is wrong :**

1. Bad smelling secretions from the uterus is from the symptoms of syphilis disease. ( )  
2. Milk, wood and cartoon are examples of transparent media. ( )

**B Give reasons for :**

It is preferred to install mercury bulbs in car's head lights.



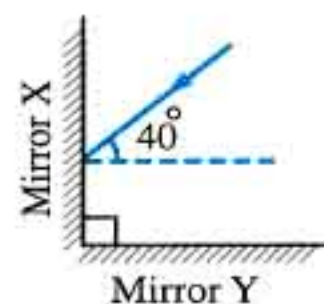
Answer the following questions :

## Question

1

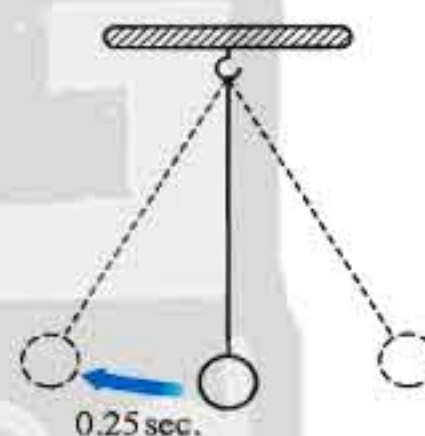
## A Complete the following statements :

1. Kinetic energy of simple pendulum reaches its ..... when it passes its rest position.
2. The crest in ..... wave is equivalent to ..... in longitudinal wave.
3. From the opposite figure :  
The angle of reflection of the ray on Mirror (Y) is .....
4. Testes secrete ..... hormone, while ovaries secrete the female hormones ..... and progesterone.



## B What happens in each of the following cases ... ?

1. Increasing the frequency of a wave to its double when the wave velocity is constant. (Concerning wavelength)
2. To the ovary after fertilization in plants.
3. Transferring a light ray from glass to air.
4. When the frequency of this simple pendulum in the opposite figure, is equal to its periodic time ?



## Question

2

## A Write the scientific term for each of the following :

1. It is the motion produced as a result of the vibration of the particles of the medium in a certain moment and in a certain direction.
2. It is the rebound of light waves in the same medium on meeting a reflecting surface.
3. It is the process of transfer of pollen grains from the flower's anthers to the stigmas.
4. A tube with a funned shaped opening transport the ovum to the uterus.

## B Mention one use or function for each of the following :

1. Radio waves.
2. Ultrasonic waves in medical fields.
3. Corolla.
4. Genital glands in male.

## C Savart's wheel rotates with a rate of 300 cycles per minute. A sound of frequency 600 Hz is produced when an elastic plate touches the teeth of gear. Calculate the number of teeth of the gear.



## Question 3

## A Choose the correct answer :

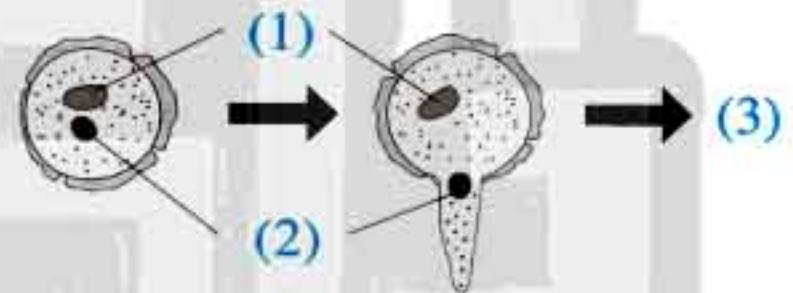
- If the frequency of an oscillating body was 2 Hz, so the time of one amplitude is ..... sec.  
a. 1/2                      b. 1/4                      c. 1/8                      d. 2
- The sound of frequency 200 Hz is ..... than the sound of frequency 100 Hz.  
a. stronger                      b. sharper                      c. weaker                      d. harsher
- The produced fruits by grafting belong to the type of the .....  
a. scion.                      b. cut.                      c. stock.                      d. bud.
- Water waves propagate through **10 m**, by frequency **5 Hz** in **5 seconds**, so the number of waves and velocity of propagation respectively are .....  
a. 50 waves, 2 m/s.                      b. 25 waves, 2m/s.                      c. 100 waves, 5m/s.                      d. 25 waves, 5m/s.

## B Give reason for each of the following :

- The piano sound differs from that of a violin even if they the same pitch and intensity.
- The fish in water is seen in an apparent position slightly above its real position.
- Palm flowers are unisexual.

## C From the opposite figure :

- The figure represents .....
- Write the labels of the figure ?
- Draw stage number (3) from this figure ?



## Question 4

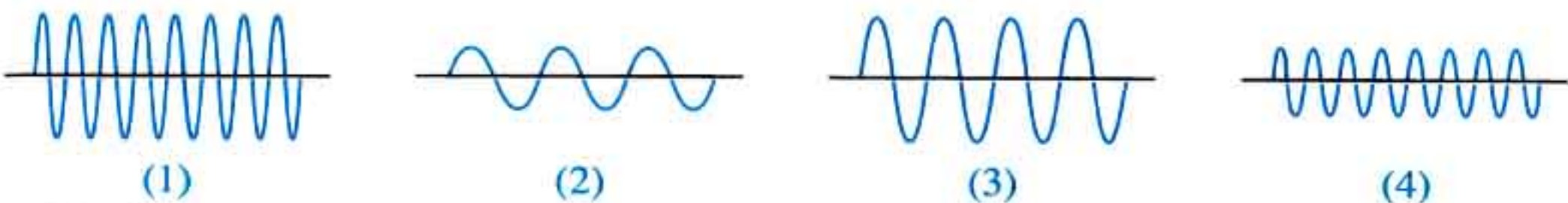
## A Correct the underlined words in the following statements :

- Grafting by wedge is applied in Mango trees.
- The absolute refractive index of any transparent material is always smaller than one.
- In pollination by water the flower has feathery like and sticky stigma.
- Particles of the medium vibrate along the direction of wave propagation in the transverse wave.

## B Compare between :

The sperm and the ovum. (in terms of : Number - size - motion)

## C From the following figures :



- The figure ..... represents the strongest harsh sound.
- The figure ..... represents the sharp weak sound.
- The figure ..... represents the minimum frequency.



## Additional questions

**A** Extract the unsuitable word or statement, then write the relation between the rest :

1. Vomiting / High body temperature / Chilling / Face paling.
2. Wood / Concrete / Air / Metal.

**B** Put (✓) or (✗) then correct what is wrong :

1. Puerperal sepsis disease can infect both male and female. ( )
2. The objects can be seen clearly through transparent media. ( )

## 21 Fayoum Governorate

Educational Directorate

Answer the following questions :

## Question

1

**A** Complete the following statements :

1. A complete oscillation comprises ..... successive displacements, each of which is called .....
2. The sperm consists of ....., middle part and .....
3. Angle of ..... is the angle between the refracted light ray and ..... at the point of incidence on the separating surface.
4. The crest in ..... wave is equivalent to ..... in longitudinal wave.
5. The ..... after fertilization forms the fruit.

**B** What is meant by ... ?

1. Wavelength of longitudinal wave.
2. Pollination.
3. Light reflection.

**C** What is the importance of ... ?

1. Sonar sets.
2. Savart's wheel

## Question

2

**A** Correct the underlined words in the following statements :

1. The result of multiplying the frequency of an oscillating body by its periodic time equals variable value.
2. Hermaphrodite flowers take the symbol ♂.
3. Angle of refraction = angle of reflection.
4. A body of frequency 200 Hertz makes a complete oscillation in 2 seconds.
5. Sonic waves of frequency range between 10 Hertz to 200 kilo Hertz.
6. The estrogen hormone is responsible for pregnancy to continue.

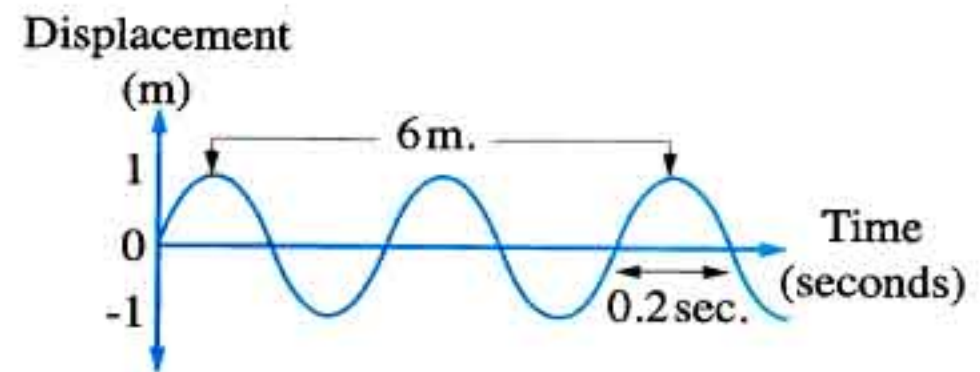


**B Compare between each of :**

1. Ovary and testes (found in which system).
2. Longitudinal waves and transverse waves. (direction of vibration of medium particles to direction of wave propagation)

**C From the opposite figure, find :**

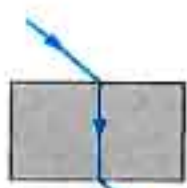
- |                 |                    |
|-----------------|--------------------|
| (a) Wavelength. | (b) Frequency.     |
| (c) Amplitude.  | (d) Wave velocity. |

**Question****3****A Write the scientific term for each of the following statements :**

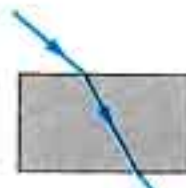
1. The number of complete oscillations produced by the oscillating body in one second.
2. The property by which the human ears can distinguish between sounds either strong or weak.
3. Changing the path of light when travel from a transparent medium to another transparent medium of different optical density.
4. A new method to produce large numbers of plants from a small part of it.
5. A natural phenomenon takes place on the desert roads at noon especially in the summer times.

**B Choose the correct answer to complete the following statements :**

1. Fertilization occurs when ..... is formed.  
a. embryo      b. zygote      c. endometrium      d. ovum
2. If the distance between the centre of the third compression and the centre of the fifth compression on the wave propagation is 40 cm, Then, the wavelength of this wave is .....  
a. 40 cm.      b. 20 cm.      c. 10 cm.      d. 5 cm.
3. A sound wave travels in air with velocity 330 m/s and has a wavelength of 0.1 m, its frequency is .....  
a. 330 KHz.      b. 3300 Hz.      c. 33 KHz.      d. 330 Hz.
4. Choose from the following figures the one that express correctly the refraction of light in a rectangular glass block is the figure .....



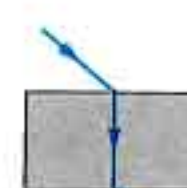
(a)



(b)



(c)



(d)

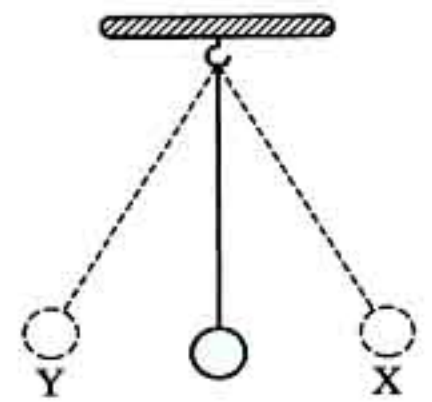


## PART

## 3

5. In the opposite figure when the ball of the pendulum moves from (x) to (y) in a duration of 0.01 seconds, the frequency equals ..... Hertz.

- a. 0.04                      b. 0.02  
c. 25                         d. 50



**C** Calculate the velocity of light in glass given that the velocity of light in air equals  $3 \times 10^8$  m/s and the absolute refractive index of glass is 1.5.

**D** What happens in the following cases ... ?

The increasing in the frequency of a wave to double its value with respect to the wavelength when the wave velocity is constant.

## Question

## 4

**A** Give reasons for :

1. The man, whose testicles are still present inside the abdominal cavity, is infertile (sterile).
2. Auto pollination can't happen in sunflowers
3. Sound can be heard from all surrounding directions.

**B** Calculate the frequency of a musical tone similar to the frequency of an emitted tone using Savart's wheel rotated with a velocity of 960 cycles in two minutes, given that the number of teeth of the gear is 30 teeth.

**C** Mention the sex of each of the following flowers :



1. Flower : .....



2. Flower : .....



3. Flower : .....

## Additional questions

**A** What is meant by ..... ?

1. Translucent media.
2. Incubation period.

**B** Rewrite the following statements after correcting the mistakes :

1. White light is a mixture of five colours known as bright colours.
2. Syphilis disease is caused by spherical bacteria.



22

Minya Governorate

Minya Official Language School

Answer the following questions :

Question

1

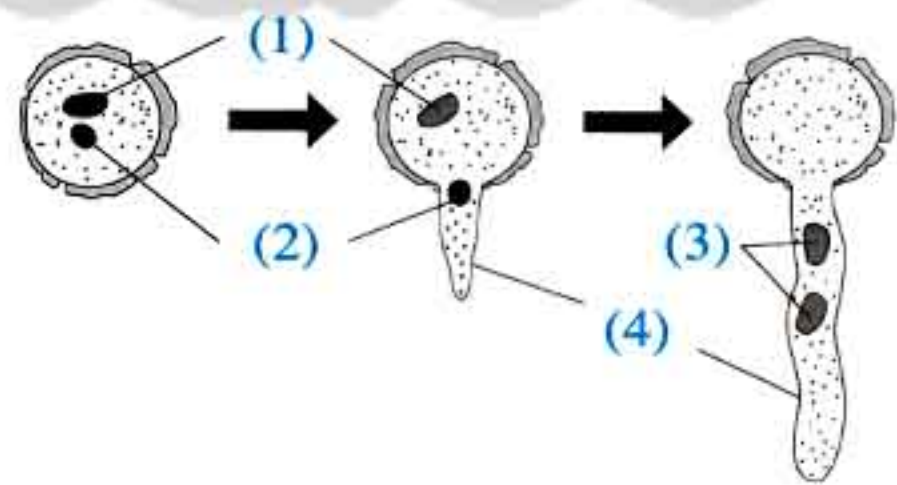
A Choose the correct answer :

- The complete oscillation includes ..... displacements.
  - two successive
  - three successive
  - four successive
  - two successive
- The floral which is not found in female flower is .....
  - calyx.
  - gynoecium.
  - androecium.
  - corolla.
- If the distance between the sound source and the ear increased 3 times, so the sound intensity .....
  - decreases to half.
  - increases 3 times.
  - decreases to 1/3.
  - decreases to 1/9.
- When the incident ray falls perpendicular on a reflecting surface, the angle of reflection equals .....
  - 120°
  - 0°
  - 90°
  - 60°
- Fertilization occurs when ..... is formed.
  - embryo
  - zygote
  - endometrium
  - ovum
- Sound frequency 200 Hz is ..... sound of frequency 100 Hz.
  - sharper than
  - stronger than
  - harder than
  - weaker than
- The periodic time of an oscillating body which makes 240 oscillations in one minute = .....
  - 1 sec.
  - 1/4sec.
  - 1/2 sec.
  - 4 sec.

B Savart's wheel rotates with rate of 150 cycle per minute. If the number of teeth of the gear is 60 teeth Calculate sound frequency.

C Study the opposite figure, then answer :

- the figure represents .....
- write the labels of the figure.



Question

2

A Complete the following statements :

- Sweet potatoes are considered as ..... , while the potatoes are ..... and reproduction in them is done by .....
- ..... differ according to the nature of the ovary either containing one or many ova.
- The absolute refractive index for water is the ratio between ..... and .....
- The simple harmonic motion is considered the simplest form of ..... motion.

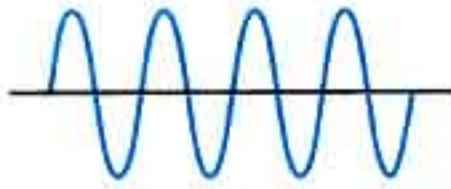


## PART

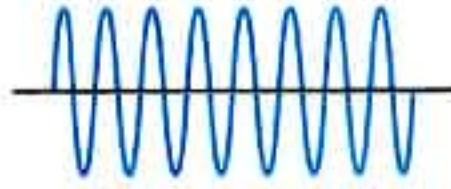
## 3

- B Define :** 1. Pollination. 2. Refraction angle.

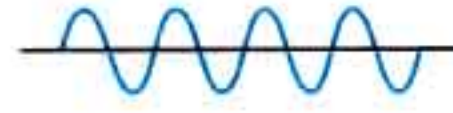
- C Study the following figures, then answer the questions :**



(a)



(b)



(c)

1. Which of these figures represents woman voice ?
2. Which of these figures represents strong harsh sound ?
3. Complete : sound intensity is measured by ....., but noise intensity is measured by .....

## Question

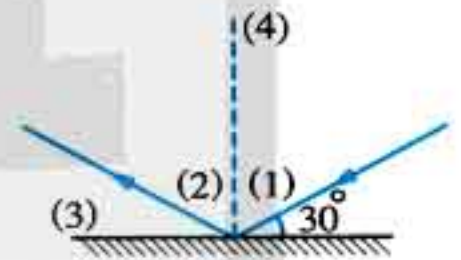
## 3

- A What happens when ... ?**

1. A stigma of a flower doesn't secrete sugary solution after pollination process.
2. The sound wave travels from air to water (concerning its velocity).
3. The oscillating body reaches the position of its max. displacement during its movement.
4. The wavelength increases to the double value when the wave velocity is constant. (concerning the frequency)

- B Look at the opposite figure then answer :**

1. Complete labels 1, 2, 3 and 4.
2. Calculate the measurement of angle number 2
3. The angle of incidence is the angle number ..... and it equals .....



- C What is meant by ... ?**

1. The distance between two successive crests in infra-red wave.
2. Sound waves have frequency less than 20 Hz.

## Question

## 4

- A Write the scientific term for each of the following :**

1. The cell resulting from the fusion of pollen grain and the ovum nucleus.
2. The waves that need a medium to propagate.
3. The property by which ear can differ between two sounds even have same pitch and intensity.
4. A swollen part in the flower carries floral whorls.

- B Give reasons for :**

1. The petals of corolla are colored and scented.
2. Ultrasonic waves are used in sterilizing the food.
3. If the candle is put in front of a tuning fork, the candle flame vibrates.
4. Sound intensity in the presence of carbon dioxide gas as a medium is stronger than in air.



## C Correct the underlined words :

1. Sugar cane is reproduced by grafting.
2. The wall of the ovary after fertilization form fruit.
3. The rose is a group of flowers arranged on the same axle.
4. Particles of the medium vibrate along the direction of the wave propagation in the transvers waves.

## Additional questions

## A Complete the following statements :

1. Visible light is one of the components of electromagnetic spectrum of wavelength ranges between ..... to ..... nanometres.
2. The microbe that causes the syphilis is .....

## B Give reasons for :

Wood doesn't allow the passage of light through it.

## 23 Aswan Governorate

Aswan Educational Directorate

## Answer the following questions :

## Question

1

## A Complete the following statements :

1. The bisexual flower contains ..... and .....
2. The velocity of the oscillating body is maximum, when it passes through .....
3. The complete oscillation includes ..... displacements each of them is called .....
4. In the reproductive system of the human male, each testis is attached to highly looped tubes known as .....
5. From the natural phenomena that are related to the refraction and reflection of light are ..... and .....
6. The absolute refractive index is the ratio of ..... to .....

## B Give reasons for :

1. The use of ultrasonic waves in milk sterilization.
2. The petals of corolla are colorful and scented.

## Question

2

## A Write the scientific term :

1. The number of complete oscillations produced by the oscillating body in one second.
2. Sound waves of frequencies less than 20 Hz.



## PART

## 3

3. Short stem where the leaves developed and modified into reproductive organs.
4. A hormone produced by the testes.
5. The incident ray and the reflected ray and the normal from the point of incidence on the reflecting surface all locate in the same plane perpendicular on the reflecting surface.

**B What is meant by the following ... ?**

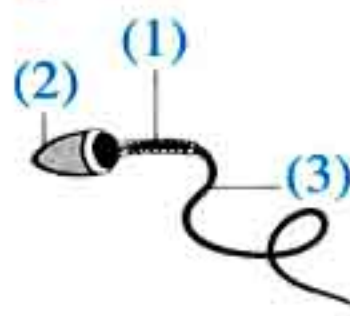
1. Pollination.
2. The wavelength of a sound wave = 1.5 m.

**Question****3****A Put (✓) or (x) :**

1. The sound quality is the property by which the ear can distinguish between strong sounds and weak sounds. ( )
2. The calyx is the male reproductive organ in the flower. ( )
3. The light ray refracts towards the normal, when it travels from air to glass. ( )
4. The human female's ovule is a settled sphere shaped cell. ( )
5. The particles of the medium vibrate along the direction of the wave propagation in the longitudinal waves. ( )

**B Calculate the frequency of a musical tone similar to the tone produced from a savart's wheel rotating with a velocity of 960 revolution in 2 minutes, knowing that the number of gear teeth = 30.****Question****4****A Choose the correct answer :**

1. The sound waves are ..... waves.  
a. longitudinal      b. transverse      c. electromagnetic      d. no right answer.
2. Fertilization occurs when ..... is formed.  
a. embryo      b. zygote      c. endometrium      d. ovum
3. All the following methods are examples for the artificial vegetative reproduction except .....  
a. cutting.      b. bulbs.      c. grafting.      d. tissue culture.
4. If the angle between the incident ray and the normal at the point of incidence on the reflecting surface = 50, so the angle of reflection = .....  
a. 40°      b. 50°      c. 130°      d. 60°

**B Write the labels on the following figure :**



## Additional questions

## A Put (✓) or (✗) then correct what is wrong :

1. Appearance of tumors in liver, bones and parts of genital organ are from the symptoms of syphilis disease. ( )
2. Light is a mechanical transverse waves. ( )

## B Write the scientific term of the following :

The scientist who proved that the energy of the photon depends on its frequency.

24

New Valley Governorate

El-Dakhla Educational Directorate

Answer the following questions :

## Question

1

## A Complete the following statements :

1. Sharp tones have ..... frequencies, while rough tones have ..... frequencies.
2. The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.
3. .... is the male reproductive organ in the plant, while ..... is the female reproductive organ in the plant.
4. Harmonic tones are lower in ..... and higher in ..... than fundamental tones.

## B Give reason for each of the following :

1. Vegetative reproduction is considered asexual reproduction.
2. The periodic time decreases as the number of complete oscillation increases.
3. The pen seems broken when it is put in a glass of water.
4. The use of ultrasonic waves in milk sterilization.

## C Sound waves have frequency 400 Hz in air and its wavelength is 85 cm., Calculate the velocity of this wave.

## Question

2

## A Write the scientific term for each of the following :

1. Short stem which leaves are developed and modified into reproductive organs.
2. The measuring unit of wavelength.
3. It is disturbance which the particles of the medium vibrate along to the direction of wave propagation.
4. The flower that has four whorls.
5. The fusion of male gamete nucleus with the female gamete nucleus.



## PART

## 3

## B Compare between :

1. Sperm and ovum (mobility).
2. Grafting by attachment and grafting by wedge.

## C Define each of the following :

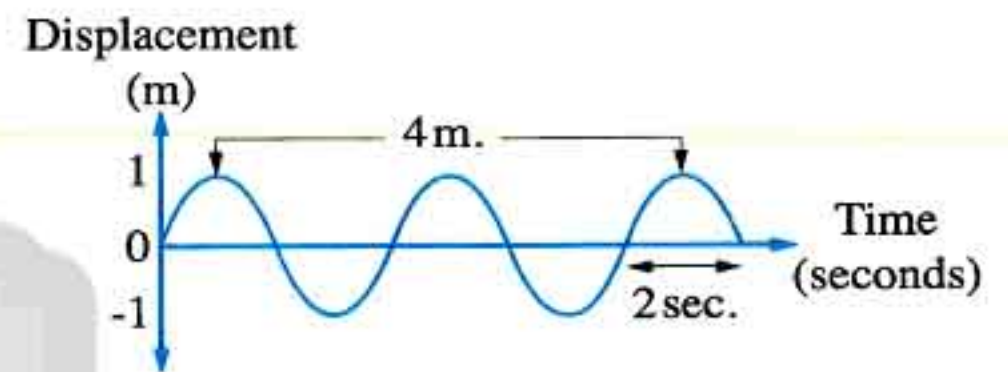
1. Light reflection.
2. Amplitude.

## Question

## 3

## A From the opposite figure, Find :

1. Wavelength.
2. Frequency.
3. Amplitude.
4. Wave velocity.



## B What is meant by ... ?

1. Angle of incidence =  $30^\circ$
2. The number of complete oscillation made by an oscillating body in 10 seconds is 500 complete oscillation.

## C Choose from column what suits the words of group :

| (A)   | (B)   |
|---|---|
| 1. It is used to determine the frequency of unknown tone  | a. female reproductive organ in the flower. |
| 2. An electromagnetic wave that can travel through free space                                   | b. pollination.                             |
| 3. The process by which pollen grain transfer from the anther of flower to the stigma of flower | c. savart's wheel.                          |
| 4. Gynoecium  | d. light.                                   |

## Question

## 4

## A If the frequency of the sound produced by touching metallic plate with a gear in savart's wheel is 100 Hz calculate the number of the gear teeth if the wheel rotates with speed 200 cycle/minute.

## B What happens when ... ?

1. Decreasing the amplitude of sound source to its half (concerning to sound intensity).
2. The ovaries stop secreting progesterone.

## C Correct the underlined words in the following statements :

1. The produced tone from tuning fork is called complicated tone.
2. The measuring unit of sound intensity is m/sec.
3. Growing prevents living organisms from extinction.
4. Rainbow phenomenon takes place on desert roads at afternoon specially in summer.
5. Structure the stamen is stigma, style and ovary.



## Additional questions

## A Choose the correct answer :

- If the frequency of red colour is  $4 \times 10^{12}$  Hz, the frequency of violet colour is .....  $\times 10^{12}$  Hz.  
a. 1.5                      b. 3.5                      c. 4                      d. 7.5
- The human skin is considered as a/an ..... medium.  
a. transparent              b. opaque                      c. translucent              d. no correct answer.

## B Write the scientific term :

A genital disease from its symptoms high elevation in body temperature, face paling and bad smelling secretions from uterus.

## 25 South Sinai Governorate

## Tur Sinai Educational Directorate

Answer the following questions :

## Question

1

## A Write the scientific term for each of the following :

- The angle between the emergent light ray and the normal at the point of emergence on the interface.
- A property of sound by which the ears can distinguish between sharp and rough sound.
- A short stem whose leaves are developed and modified into reproductive organs.
- A disturbance that propagates and transfers energy along the direction of propagation.
- The intensity of sound at a point varies inversely with the square of the distance between the point and the sound source.
- A hollow pear shaped organ has a muscular wall that can expand as the fetus grows.
- Part of root, stem, or leaf that taken from a plant for reproduction.

## B Give reasons for each of the following :

- We see lightning before hearing thunder.
- Ultrasonic waves are used to sterilize milk.
- The sperm contains the middle part.
- Plants produce pollen grains by huge numbers.

C Calculate the absolute refractive index of diamond given that the speed of light through it is  $1.25 \times 10^8$  m/s, knowing that speed of light through air is  $3 \times 10^8$  m/s. Write the law.



## PART

## 3

## Question

2

## A Choose the odd word out, then link between the rest words :

1. Water wave – Radio wave – Light wave – Sound wave.
2. Prostate – Fallopian tube – Uterus – Ovary.
3. Sepals – Petals – Tubers – Carpels.

## B Compare between :

1. The sperm and the ovum (related to the volume).
2. Infrasonic and sonic waves (related to the frequency).

## C Calculate the frequency of an oscillating body makes 300 complete oscillation in half minute, Write the law

## D The opposite graphs represent two sound waves complete :

1. Figure ..... represent high pitch.
2. Figure ..... represent high intensity.

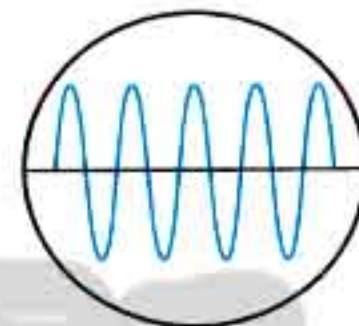


Fig. (1)

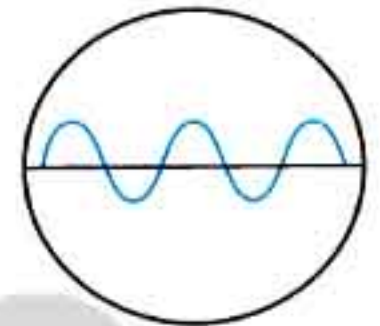


Fig. (2)

## Question

3

## A Correct the underlined words :

1. The estrogen hormone responsible for the appearance of secondary sex characters in male.
2. The flower which pollination is occurred by insects has hanged anther and sticky stigmas.
3. The measuring unit of noise is Watt/m<sup>2</sup>.
4. The transvers waves consist of compressions and rarefactions.
5. Light waves used in radars.
6. The motion of clock pendulum is a transitional motion.
7. The complete oscillation includes two amplitudes.

## B What is meant by ... ?

1. Tulip flower is a hermaphrodite flower.
2. The wavelength of sound wave is 30 cm.

## C Write one importance of :

1. Jacuzzi.
2. Savart's wheel.
3. Vas deferens.



## Question 4

## A Join from (A) to (B) :

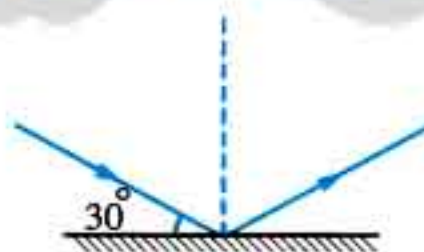
| (A)   | (B)                               |
|---|-----------------------------------|
| 1. Light ray travels from glass to air  | a. sound intensity increases      |
| 2. Fusion of the nucleus of the male gamete with the nucleus of the female gamete | b. germinates forming pollen tube |
| 3. Sound source touches a resonance box   | c. refracts nearer to the normal. |
| 4. Pollen grains sticks on the stigma   | d. forming zygote                 |
|   | e. refracts far from normal       |

## B Choose the correct answer :

- If frequency of an oscillating body = 6 Hz , so the periodic time = ..... second.  
a. 6                      b.  $\frac{1}{6}$                       c. 0.6                      d. 0.006
- Sound of different musical instruments can be differentiated from each other by .....  
a. harmonic tones.    b. fundamental tone.    c. sound intensity.    d. sound pitch.
- The zygote contains ..... of number of chromosomes.  
a. half                      b. all                      c. quarter                      d. double
- The ovary of the ..... flower contains one ovule.  
a. olives                      b. tomato                      c. bean                      d. peas
- The submerged object in water is seen in an apparent position slightly above its real position due to ..... of light.  
a. reflection                      b. interference                      c. diffraction                      d. refraction

## C A sound wave of frequency 200 Hz and wavelength 1.7 m., calculate its speed in air. Write the law.

## D In following figure calculate the angle of incidence and angle of reflection.



## Additional questions

## A Put (✓) or (✗) then correct what is wrong :

- The incubation period of puerperal sepsis disease ranges from 1 to 4 weeks. ( )
- Energy of the photon = planck's constant + frequency of the photon. ( )

## B Give reason for :

- A tissue paper is a translucent medium
- It is necessary to wear masks during labour process.